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ORIGINAL MEMOIRS

PROSTATISM.

THE SURGICAL ANATOMY AND PATHOLOGY OF THE OPERATIVE TREATMENT.

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THE favorite method of treatment for prostatic dysuria is suprapubic prostatectomy according to Freyer's method. Although it is the rule for a speedy and complete recovery to take place, the operation is associated with a certain mortality and sometimes is followed by disagreeable complications and despite the brilliant successes of a limited number of surgeons, the mortality and after-results obtained by the majority warrant the conclusion that this operation for the relief of prostatic dysuria is neither a safe nor a certain operation in many cases. Reasons may be advanced to explain this state of affairs on clinical grounds, but an accurate conception of them can only be obtained after the surgical pathology of the disease is studied in the light of the operative treatment. It is the object, therefore, of this paper to consider the question of the treatment of prostatic dysuria from the stand-point of its pathology and the pathological findings observed in the parts removed by operation, in cases terminating fatally and in cases dying naturally of the disease. Material of this nature has been examined from 134 cases.

Definition.—The prostate gland is frequently the site of

disease which produces local deformity of the organ, interference with the complete emptying of the bladder, damage to the genito-urinary tract above and serious ill-health of the patient. The clinical indications of these are designated prostatism.

It is recognized that prostatism may arise from a variety of pathological lesions, the majority producing hypertrophy of the gland. All are of the nature of chronic prostatic disease, and at one period are amenable to direct operative treatment. The latter have been gradually evolved until to-day three main routes of access are employed: (1) the suprapubic—extraperitoneal transvesical; (2) the perineal, and (3) the transurethral, the last being used for the division of the constriction by the cautery or prostatic punch.

ANATOMY OF THE PROSTATE GLAND.

The changes met with in the prostate gland in cases of prostatism vary widely and have a morbid anatomy that differs pronouncedly from the normal standard, so much so, that, if the operative treatment of prostatism is carried out solely on an anatomical basis, confusion arises and disaster is liable to follow.

I propose to describe these variations fully, but before doing so, shall refer to certain points in the normal anatomy that are of especial importance and the subject of controversy.

Lobes.—The number of lobes assigned to the prostate gland will depend on the method of anatomical description employed, but whether it be subdivided into two lateral lobes or separated into five segments, as I shall do in this paper, it must be borne in mind, that they form a homogeneous entity, and are fused into a single organ, and that in health, they are no more capable of individual enucleation by blind finger dissection, than are the lobes of the female breast. The gland envelopes the prostatic urethra, much the greater part of it being situated behind it, and is traversed by two channels, the urethra and the ejaculatory ducts, and these may be used to subdivide the gland into five segments. On either side of the urethra lie the *lateral lobes,* in front is the *anterior lobe,* the triangular wedge of gland tissue behind the urethra, and above the ejaculatory ducts forms the *middle lobe,* the corresponding portion below the *posterior lobe.*

Investing Membranes.—These are two in number, the capsule, and the

sheath. The term 'capsule' is used to designate the fibromuscular envelope that surrounds the gland intimately and sends septa into its substance, and is so intimately incorporated with it that it is normally absolutely incapable of separation from it by blunt dissection. The sheath is the outer fibrous investment loosely connected with the capsule of the prostate, except in front where the two membranes are intimately incorporated, and below where it is united to the neck of the gland. The sheath is usually described as being derived from the visceral layer of pelvic fascia, more particularly those divisions of it known as the "vesical" and "rectovesical" layers. Elliot Smith and Derry, following the French School of Anatomists, describe the prostatic sheath as having a three-fold origin. (1) In front it is derived entirely from the mesodermic tissue surrounding the blood-vessels of the prostatic plexus. The puboprostatic true ligament is therefore essentially a vascular cord. (2) Laterally this perivascular tissue also forms the sheath, but it is here reinforced by the fascia covering the inner aspect of the levator ani muscles. (3) Posteriorly it is formed by the fascia of Denonvillier, which is the obliterated lower limit of the rectovesical peritoneal pouch. This peritoneal fossa, in the new-born infant normally reaches as low as the lower limit of the prostate but later this portion of it is obliterated so that two loosely adherent sheets remain between the rectum and prostate and form Denonvillier's fascia.

I have studied the evolution and structure of the prostatic sheath in fifty subjects, the prostate being hardened *in situ*, embedded in celloidin and complete serial sections made with a Bruce's microtome, and confirm the accuracy of the above-mentioned description. The constituent elements of the sheath can be best observed in microscopic sections made of the pelvis of fetal, full-time, and recently-born male infants (Figs. 1–6). They are also easily observed in sections similarly made from the youth and the adult (Figs. 7 and 8).

The description appeals to me on the grounds of its simplicity, and the accompanying illustrations, selected from a large number, demonstrate its accuracy.

Blood-vessels.—The veins of the prostatic plexus are formed mainly from the dorsal vein of the penis which makes the vertical stem of a "Y" lying in front. The limbs of the "Y" pass backward and upward in the vesicoprostatic sulcus and receive the vesical veins as they course back to join the internal iliacs. Veins from the prostate enter the sinus especially in front. Laterally the vessels of the sinus are incorporated in the inner aspect of the sheath. From the point of view of damage to blood-vessels in prostatectomy, the dangerous area therefore lies in front (Figs. 7, 8 and 9).

Lymphatics.—Cuneo, Marcille and Walker have shown how the gathering ground for the periacinous network of lymphatics is a secondary periprostatic plexus from which four main collecting trunks pass. They are symmetrically arranged on either side of the gland, and pass in four different directions. Three pass from the posterior surface to the iliac, hypogastric, and sacral glands. A small channel passes from the anterior surface and terminates in a hypogastric lymphatic gland.

The Musculature of the Prostate and Its Relationship to Muscles.—The stroma of the prostate is richly endowed with non-striped muscle fibre; the gland in fact may be looked upon as being developed by the penetration of gland tubules into an already formed muscular tube (Fig. 2). The vesical muscles are prolonged down into the prostate. The outer longitudinal fibres pass over its capsules, the inner circular are condensed within its upper surface to form the ***internal vesical sphincter*** (Figs. 10 and 11).

Levator Ani Muscles.—These form a muscular hammock in which the prostate gland is slung. They sweep over the lateral aspect of the gland; their inner fascial covering forming as has been noted the lateral portion of the prostatic sheath. At the apex of the prostate below, they are tied by their fascia to the commencement of the membraneous urethra (Fig. 10), and in this position there is situated the external vesical sphincter, a most important muscle, the presence of which is frequently overlooked (Figs. 5 and 10). It is located around the lower limit of the prostatic urethra and extends into the membranous urethra, and must remain undamaged if complete vesical control after prostatectomy is to be absolutely assured (Fig. 12). Adjacent to the external vesical sphincter the rectum is united to the membranous urethra by the recto-urethralis muscle, the muscle fibres of which are obtained from the outer longitudinal muscular coat of the bowel (Fig. 12). These fibres pass like a fan, the handle of which is united to the urethra, the base to the rectum (Fig. 13).

Seminal Vesicles.—The sheath of the seminal vesicles is formed on its posterior aspect from the anterior layer of Denonvillier's fascia, in front from the fascia covering the outer muscular coat of the bladder, to which viscus the seminal vesicles are firmly united. They may therefore be considered as being contained within the upper part of the prostatic sheath. They are also firmly united to the prostate gland (Figs. 14–17).

Practical Deductions, Anatomical.—Before proceeding to consider the pathology of prostatism as the basis for the operative treatment it will be profitable to refer to certain practical deductions that may be made from the normal anatomy of the prostate gland with reference to the operation of prostatectomy. They are mentioned because in certain cases of prostatism the gland, although diseased, maintains its normal anatomical position, relationship and contour.

FIG. 1.

Median sagittal section of pelvis of male infant at birth showing situation and structure of prostate and seminal vesicles. Note peritoneal recess between prostate and rectum forming Denonvillier's space.

FIG. 2.

Median sagittal section of pelvis of male infant at birth showing prostate, seminal vesicles, and ejaculatory duct. Note the relationship of prostate, veins, Denonvillier's space and recto-urethralis muscle.

FIG. 3.

Horizontal section of pelvis of male infant at birth to show development of prostatic sheath. Note peritoneal recess between rectum and prostate and structure and relationship of capsule and sheath.

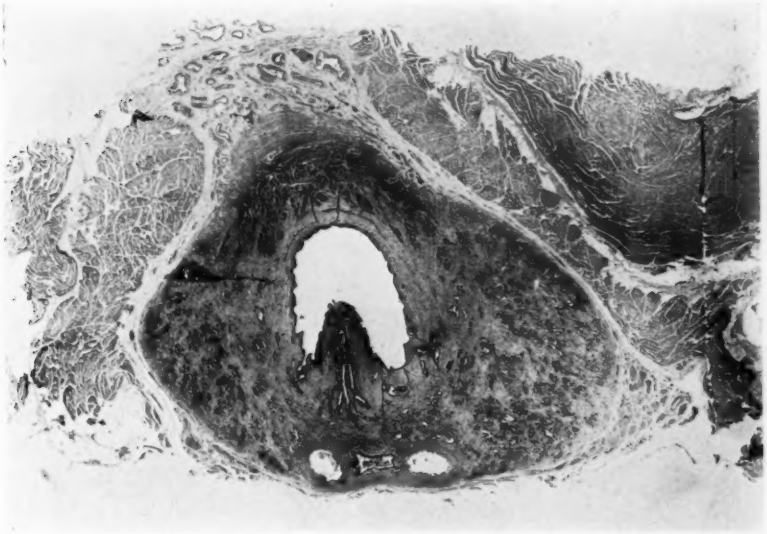
FIG. 4.

Horizontal section of pelvis of male infant at birth to show development of prostatic sheath at lower level than the former showing verumontanum and obliteration of peritoneal recess forming Denonvillier's space.

FIG. 5.

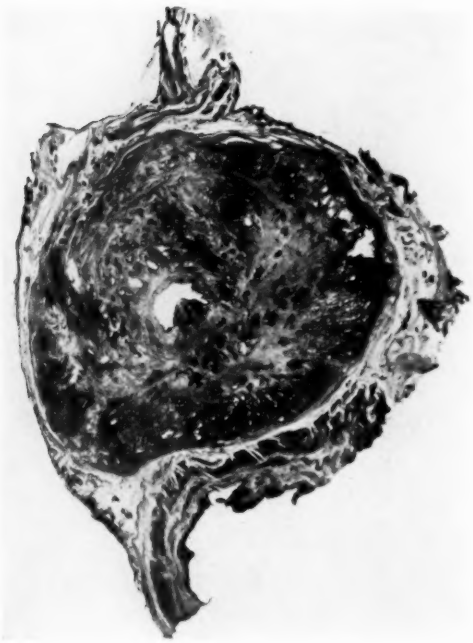
Horizontal section of pelvis of male infant at birth to show development of prostatic sheath, section at apex of prostate showing external vesical sphincter.

FIG. 6.



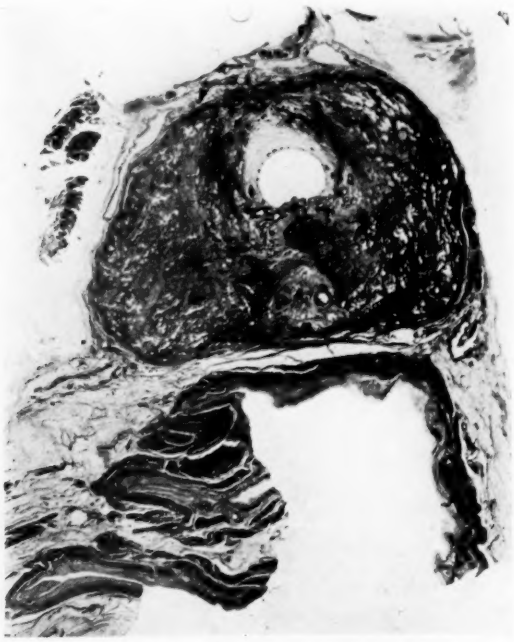
Horizontal section of prostate of infant of four months showing structure of prostate and development of sheath. Note the relationship of the sheath to vessels in front and to levatores ani latterly.

FIG. 7.



Horizontal section of prostate and rectum of young adult showing the structure and coverings of prostate.

FIG. 8.



Horizontal section of prostate and rectum showing relationship of veins of prostatic plexus, prostate and space of Denonvillier between prostate and rectum.

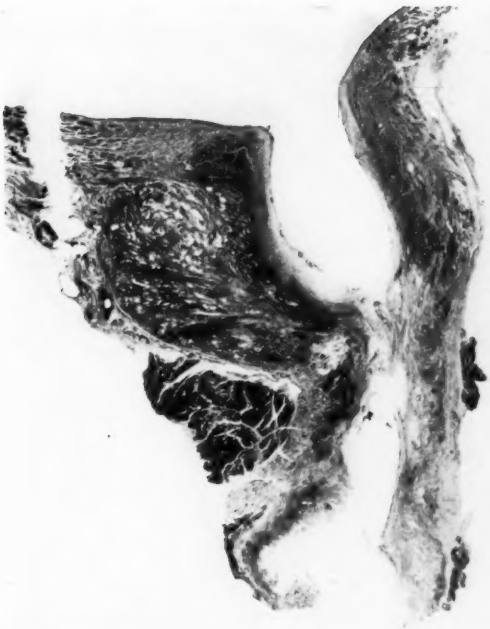
FIG. 9.

Horizontal section of prostate of man aged sixty, showing early chronic lobular prostatitis (prostatic hypertrophy) and illustrating relationship of veins of prostatic sinus.

FIG. 10.

Coronal section of adult prostate showing (1) formation of internal vesical sphincter from circular muscular coat of bladder, (2) external vesical sphincter surrounding apex of prostate and urethra, (3) indirect attachment of levator ani muscles at apex, and (4) muscular hammock in which the prostate is slung.

FIG. 11.



Vertical section, prostate, showing relationship to muscular coats of bladder and formation of internal vesical sphincter.

FIG. 12.

Horizontal section of urethra at apex of prostate showing external vesical sphincter surrounding urethra, and recto-urethralis muscle formed from external longitudinal muscular coat of rectum behind.

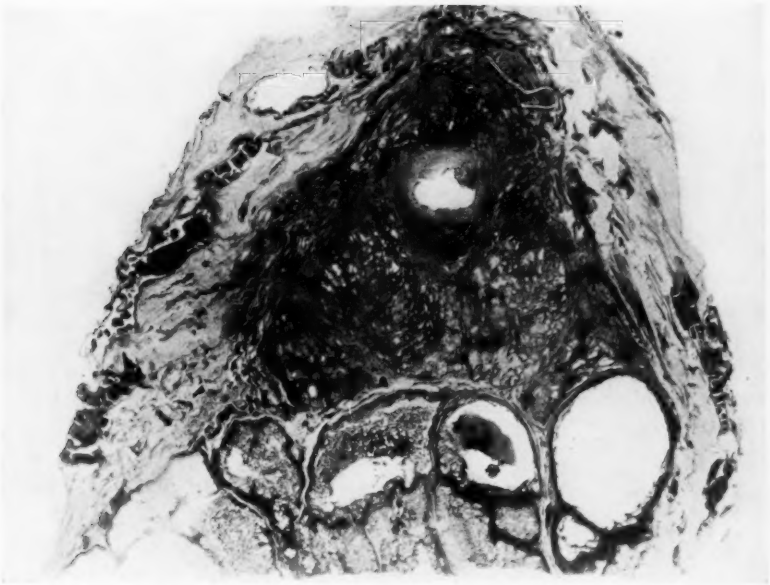
FIG. 13.

Median sagittal section, prostate, and rectum showing formation of recto-urethralis muscle and situation of Cowper's gland.

FIG. 14.

Median sagittal section of pelvis of male infant at birth showing situation, structure and relationship of seminal vesicles and ejaculatory duct.

FIG. 15.

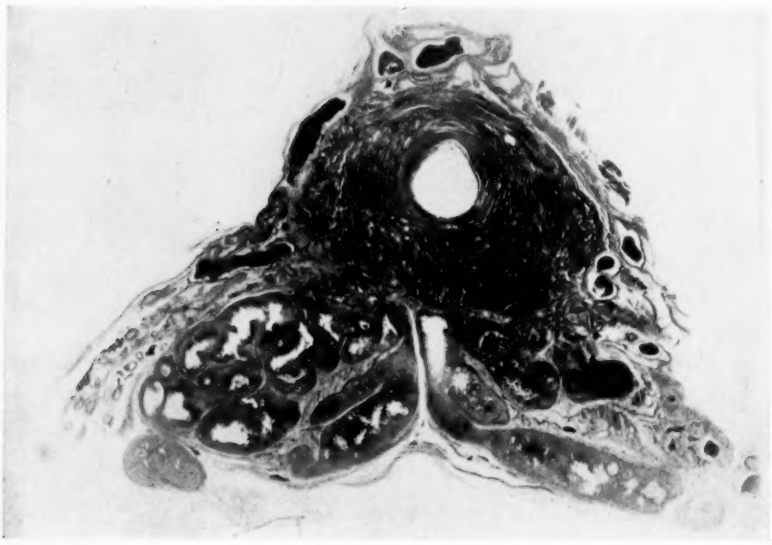


Horizontal section of prostate and seminal vesicles, showing middle lobe of prostate and its relationship to vesicles.

FIG. 16.

Median sagittal section of prostate showing situation, structure and relationship of seminal vesicles.

FIG. 17.



Horizontal section of prostate and seminal vesicles showing the fascial investment of vesicles and its relationship to prostate and blood-vessels.

FIG. 18.

Horizontal section of prostate removed by the operation of suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy). The prostate was smaller than natural size; but shows advanced disease.

When the prostate gland possesses the gross structure and relationships of the normal organ:

1. Total subcapsular enucleation by finger dissection is impossible.

2. Extracapsular enucleation by finger dissection is possible but an extremely difficult and dangerous proceeding.

3. Total excision necessitates a separation of the capsule from the sheath and as these are intimately incorporated in front the vessels of the prostatic plexus must be wounded.

4. To gain access to it from above by the suprapubic transvesical route necessitates division and possible destruction of the internal vesical sphincter, the normal prostate being an extravesical organ.

5. The external vesical sphincter will be damaged and possibly destroyed.

6. The space of Denonvillier must be opened up and as this is a very loosely obliterated peritoneal pouch, the retroperitoneal cellular tissue planes are in consequence opened as a path along which extravasated blood or an infecting virus may readily extend into the pelvic or extraperitoneal cellular tissue, if the space is not freely drained.

7. Conservation of the ejaculatory ducts is impossible in total excision by the transvesical route.

8. The seminal vesicles are likely to be damaged in enucleation and must be dissected free in excision.

PATHOLOGY OF PROSTATISM.

Incidence of Disease.—The frequency with which chronic prostatic disease producing prostatism occurs is difficult to estimate. Richardson states that chronic prostatic enlargement has been found in 34 per cent. of men over the age of sixty, and of that number 15 per cent. suffer from symptoms. Plondke has estimated that 33 per cent. of all men over 50 years of age suffer from enlarged prostate and that 10 per cent. of these require treatment. He also says that catheter life results in 100 per cent. mortality within an average period of 4 years. Personally I am unable to give accurate data not

having made enough observations to warrant definite conclusions.

Varieties of Chronic Prostatic Disease Producing Prostatism.—As I have already mentioned, I have examined specimens from 134 cases of this nature and these have included cases operated on for prostatism, cases dying naturally of the disease without treatment, and fatal cases where operative treatment has been carried out. In all of them the tissue removed was sectioned in celloidin. Paraffin sections were made of smaller portions for more accurate histological examination. Serial celloidin sections were made in most of the cases. They showed three outstanding varieties of disease leading to prostatism—(1) prostatic hypertrophy, or as I would prefer to call it, chronic lobular prostatitis (110 cases); (2) prostatic fibrosis or chronic interstitial prostatitis (10 cases); (3) prostatic carcinoma (14 cases).

Prostatic Hypertrophy of Chronic Lobular Prostatitis.—The frequency of incidence of this variety of prostatic disease as the cause of prostatism is such as apparently to lead occasionally to the belief that it is the only cause.

The etiology of this disease has been the subject of much dispute. Wilson and McGrath in their recent article enumerate 13 different theories that have been advanced to explain its origin. I do not propose to enumerate these but would suggest that the changes met with in this disease are in their essential nature so closely identical with those observed in another accessory sexual gland, the female breast, when the site of multiple cystic disease or chronic lobular mastitis, that their origin probably resides in factors that are essentially identical. In both cases the gland involved produces an accessory sexual secretion and we know now that the natural stimulus to increase functional activity in the case of the mammary gland comes to it in the form of a hormone, that would appear to be formed in the corpus luteum of the ovary subsequent to impregnation.

I am not aware whether physiologists have worked out a similar relationship between the testicle and the prostate but

it seems rational that such should exist, otherwise, the relationship of the testicle and the prostate has been widely investigated. Richardson has shown that the fecundity of an animal is in proportion to the state of development of the accessory genital glands, the most important of which is the prostate. It is also known that when an animal is castrated before the age of puberty, the full development of the prostate gland is prevented; where that gland is removed, however, in later life no essential atrophy of the prostate results. It appears to me likely that prostatic hypertrophy will be found to owe its origin to some alteration in a normal internal secretion.

I do not consider the changes found in the gland in cases of prostatic hypertrophy or, as I have called it, chronic lobular prostatitis to be indicative of a truly neoplastic process.

In chronic lobular mastitis and chronic lobular prostatitis a senile hyperplasia is present. An aberrant overgrowth of tissue occurs that is not the result of the appearance of an independent new growth, although in both cases there is a pronounced liability for the development of the same. They are liable to undergo malignant changes and to develop carcinoma. Although the changes are essentially similar, they are modified by the situation in which the glandular overgrowth has occurred. The prostate gland being firmly encapsulated and possessing a stroma so abundantly provided with muscle fibres, these tend to confine the overgrowth and produce zones of false encapsulation. Where the area of overgrowth in the prostate gland is situated near a free surface, the muscle fibres lead to its partial extrusion, in a manner similar to that in which the uterine fibromyoma is treated, when situated in the wall of the uterus. A similar process is observed in the alimentary canal with gastric and intestinal polypi.

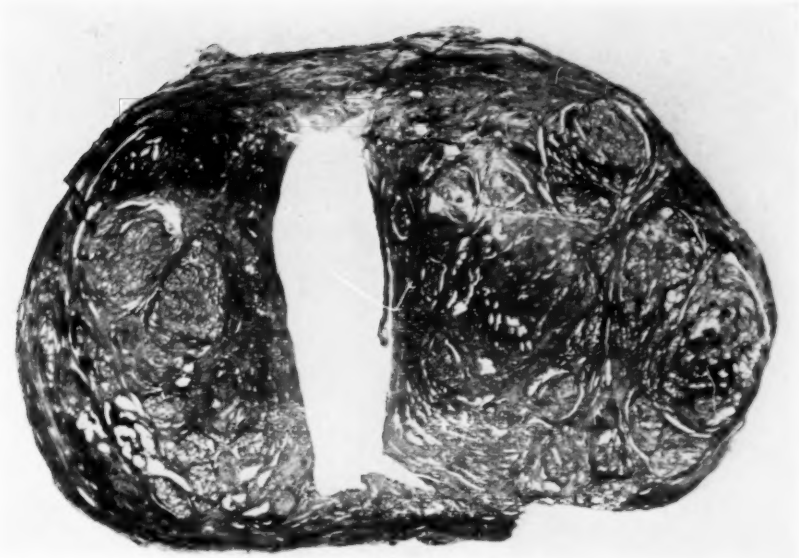
The process known as prostatic hypertrophy, or chronic lobular prostatitis, is virtually always associated with a great increase in the size of the gland, but it is occasionally met with in glands that are even smaller than normal, but clinically have produced pronounced indications of prostatic dysuria (Figs. 18 and 19).

Tandler and Zuckerkandl as a result of their investigations made on subjects dying naturally with prostatic hypertrophy claim to have shown that the process is always found involving the middle lobe. In those cases that I have examined, it is undoubtedly by far and away most commonly met with in that situation, but it is also clear that the lateral lobes are frequently involved. In one specimen the disease was confined to the anterior lobe (Fig. 20). This later condition is, however, unique.

When the hypertrophic process is confined to the middle lobe, or involves at the same time the lateral lobes, the ejaculatory ducts are displaced downward, and the posterior lobe is compressed and atrophied, and the seminal vesicles are displaced backward (Fig. 21). The importance of these changes is that the seminal ducts are carried into a region of safety, and are conserved during the operation of suprapubic transvesical prostatectomy for this disease.

When the prostate gland, the site of chronic lobular prostatitis, is sectioned and examined, it is usual to observe areas of glandular overgrowth in the later stages of which certain of the spaces become distended and show the thin wall and other characteristic appearances of a retention cyst. It is also the rule for corpora amylaceæ to be scattered throughout the area of disease. The frequency, size, and consistence of these can be well understood, when I state, it was our experience to find that in sectioning the celloidin specimens, it was the rule for the edge of the microtome knife to be broken in one out of every three specimens sectioned, owing to these stony little foreign bodies. The unaffected gland tissue is compressed and condensed along with the interglandular stroma (Fig. 22). Toward the surface of the gland, this change results in the formation of a false capsule which consists mainly of muscle strands, and fibrous tissue, but in it there can always be observed compressed and atrophied glandular acini, and these are frequently flattened out, and form a line of natural cleavage that permits of the easy separation of the diseased tissue beneath from the false capsule surrounding it without (Fig. 23).

FIG. 19.



Horizontal section, prostate, removed by the operation of suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy). Gland smaller than natural size but shows advanced disease.

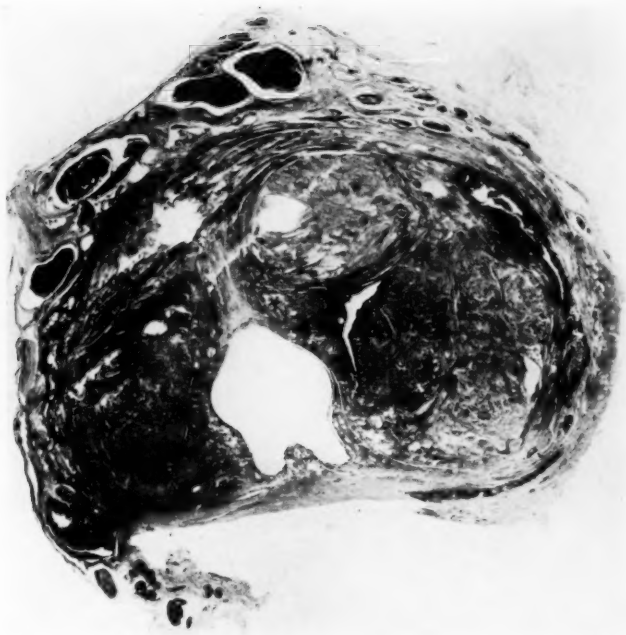
FIG. 20.

Median sagittal section of prostate and rectum showing prostatic hypertrophy (chronic lobular prostatitis) confined to anterior lobe.

FIG. 21.

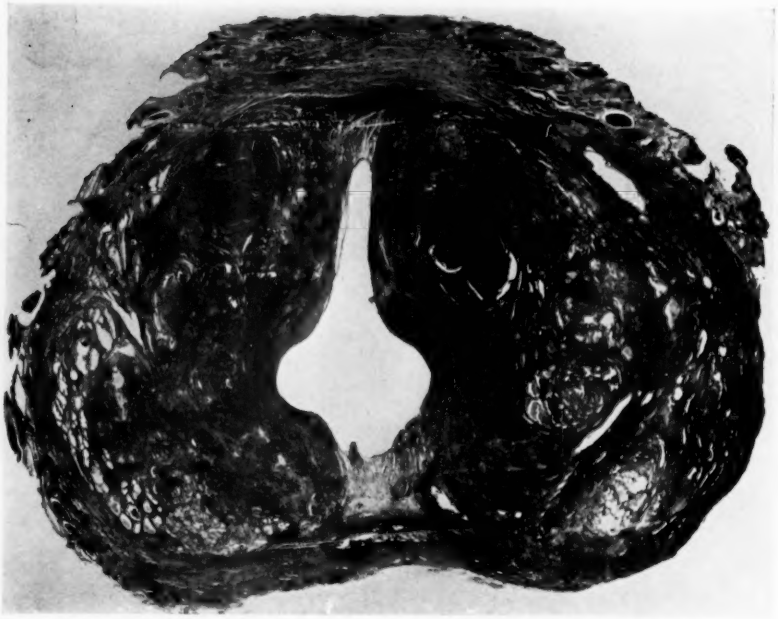
Median sagittal section of bladder, prostate, and seminal vesicles showing extreme hypertrophy of middle lobe from chronic lobular prostatitis with intravesical herniation and displacement of seminal vesicles and ejaculatory duct, and condensation of posterior lobe

FIG. 22.



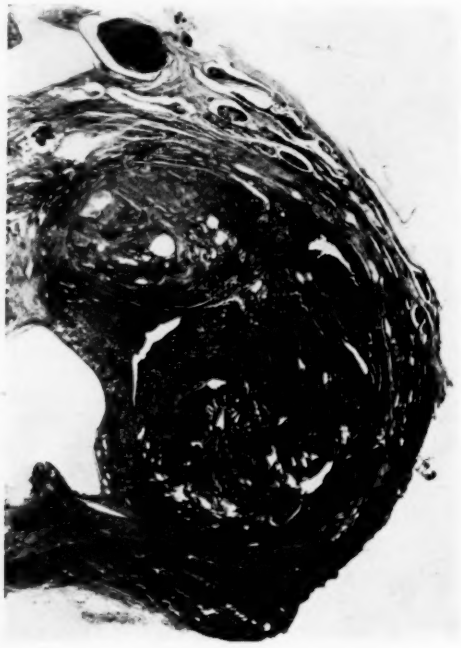
Horizontal section of prostate, the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing nodular hypertrophy in lateral lobes, formation of false capsule from uninvolved and condensed prostatic tissue and relationship of blood-vessels in sheath to this.

FIG. 23.



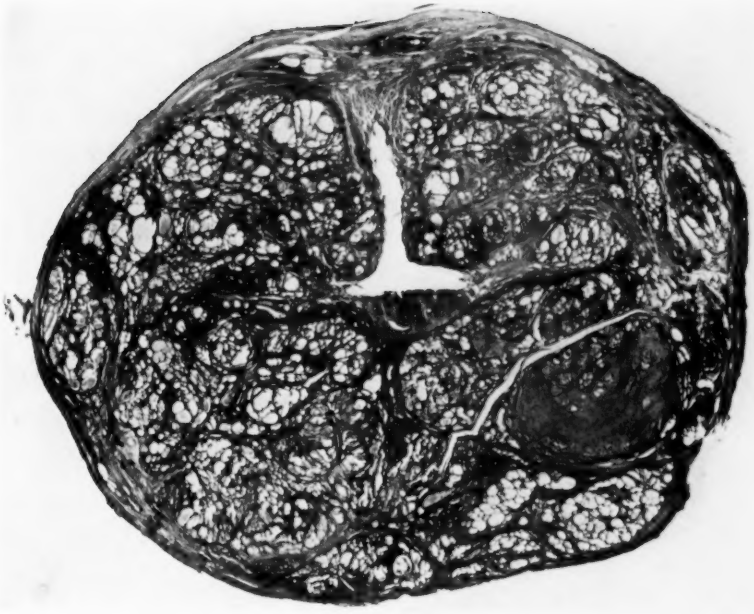
Horizontal section of prostate, the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing natural line of cleavage formed by flattened gland acini beneath false capsule.

FIG. 24.



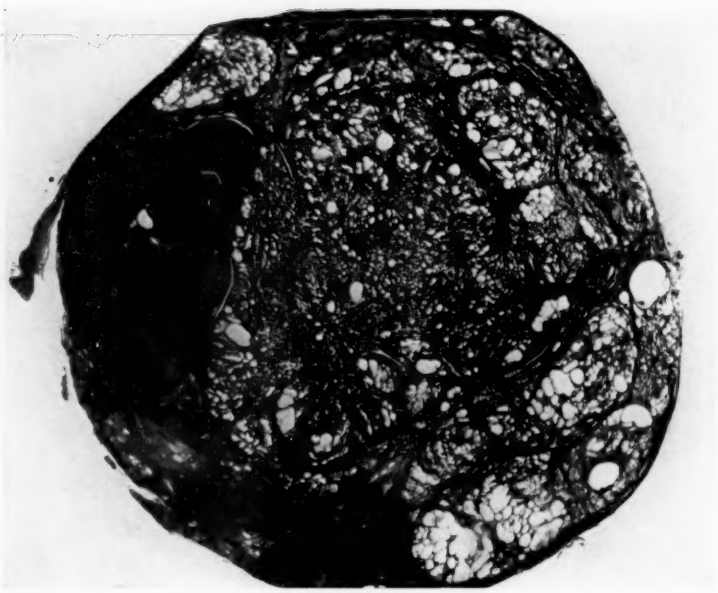
Horizontal section of prostate, the site of advanced chronic lobular prostatitis (prostatic hypertrophy) showing encapsulation by false capsule of one lobe.

FIG. 25.



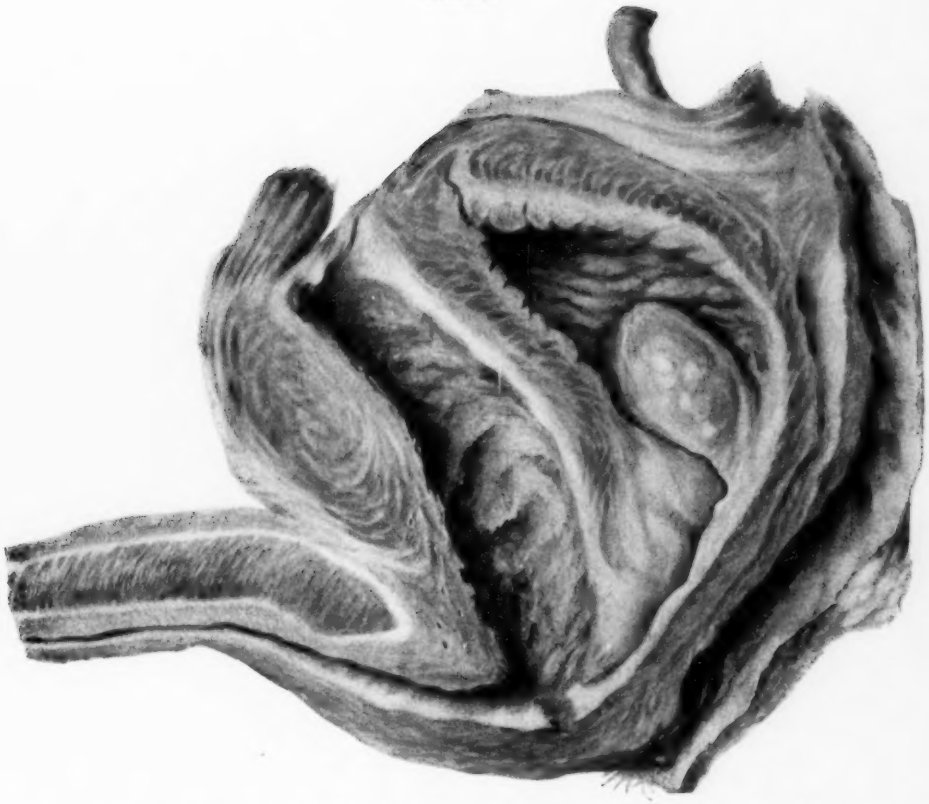
Horizontal section of prostate removed by suprapubic prostatectomy. "total" enucleation for chronic lobular prostatitis (prostatic hypertrophy) showing one fibromyomatous nodule.

FIG. 26.



Horizontal section of one lobe removed by suprapubic prostatectomy, "lobar" enucleation showing fibromyomatous nodule.

FIG. 27.

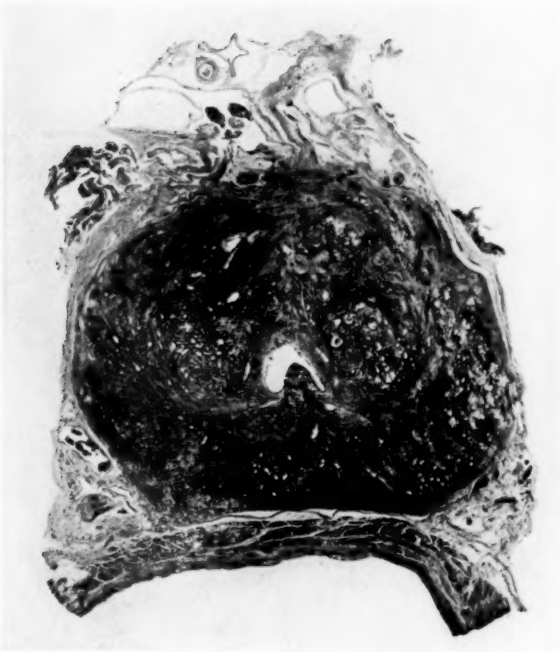


Median sagittal section of pelvic contents of man aged seventy-three, who died from rupture of urethra with extravasation of urine into space of Retzius, showing hypertrophy of middle lobe of prostate which projects into bladder. Water color drawing of case from which Fig. 21 was made.

FIG. 28.

Median sagittal section of bladder, prostate, and rectum showing middle lobe forming median prostatic "bar" in case of chronic interstitial prostatitis.

FIG. 29.



Horizontal section of prostate and rectum from a man aged seventy-three, who died suffering from prostatism, showing diffuse chronic interstitial prostatitis.

In a typical case these flattened acini form an arrangement somewhat like the perforations around a postage stamp, the perforations being, however, longer and the bridges much further apart.

The arrangement of the spheroids frequently permits of their removal in two masses so that at the operation the hypertrophied gland is described as being removed in two lobes (Fig. 24). Very occasionally a spheroidal area of hypertrophy is seen where the stroma is increased very much in amount, and the gland tissue much reduced in quantity, so that a fibromyomatous nodule is produced (Figs. 25 and 26). These are, however, not true neoplasms, and of all the cases in which I have observed it, in only one did I fail to detect the presence of atrophied gland tissue amidst the fibrous and muscular tissue, and in this case circumstances did not permit of a complete section of the entire gland. These fibroid areas are probably the result of a former inflammatory process. When the prostate gland enlarges in chronic lobular prostatitis, in addition to producing for itself a false capsule, it herniates itself through the internal vesical sphincter and comes to lie directly beneath the thin mucous membrane of the bladder floor (Figs. 21, 27, and 60).

Prostatic Fibrosis or Chronic Interstitial Prostatitis.—Of the 134 cases I have examined, ten suffered from prostatic fibrosis or chronic interstitial prostatitis. In this disease the prostate gland is smaller than normal and is of a firm fibrous consistence. The interglandular stroma is increased in amount, the whole organ being of a sclerotic nature.

It may be considered as having its origin in those various factors that so commonly produce fibrous overgrowth in the interglandular stroma of various organs of the body. The circulating toxin that has produced chronic interstitial nephritis may in a like manner produce chronic interstitial prostatitis. When the middle lobe of the prostate is especially involved, a fibrous sclerotic bar is produced, which mechanically leads to interference with the voiding of urine from the bladder and a severe degree of retention may result (Fig. 28).

It is of importance to realize clearly the morbid anatomy associated with this disease and wherein it differs from that present in chronic lobular prostatitis. In chronic interstitial prostatitis (Fig. 29) no false capsule is found surrounding the gland, there being no formation of spheroids in this condition. The natural union between the prostate gland, its capsule, and sheath, is more intimate than normal. There is no intravesical herniation of the gland so that consequently it retains its normal relationship to the internal and external sphincters.

When sections of the gland, the site of chronic prostatitis, are examined the appearance seen is very comparable to those observed in a cirrhotic kidney or liver. The glandular tissue is compressed and atrophied by strands of fibrous tissue amidst which portions of degenerative muscles are situated. Throughout the stroma, areas are present where small cells mainly of the lymphocyte type are accumulated, such as are constantly observed in processes of a similar nature elsewhere.

From the point of view of its morbid anatomy, therefore, the prostate gland in which chronic interstitial prostatitis is present differs in almost every respect from that in which chronic lobular prostatitis has occurred. It is perhaps, its misfortune that the only features it shares in common are the clinical indications of prostatism that are so closely similar as to tempt certain surgeons to treat them by a similar operative technic with occasionally disastrous consequences.

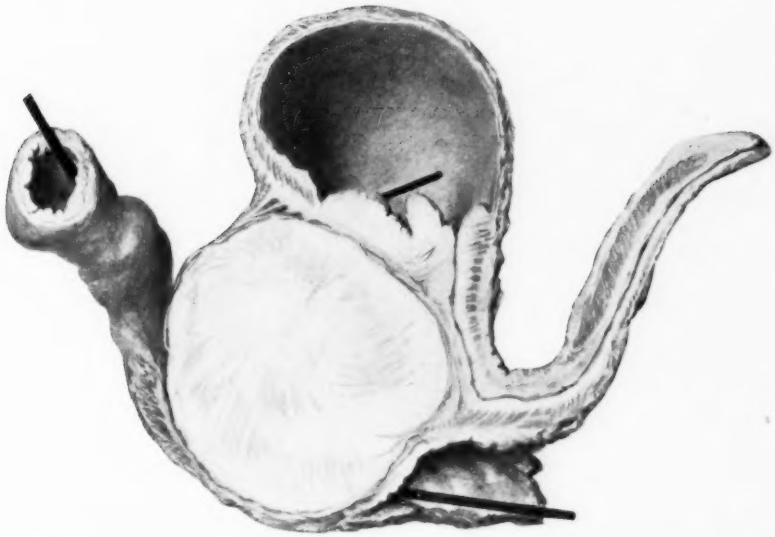
Carcinoma of the Prostate.—Of the various neoplasms of the prostate, carcinoma occurs so frequently and other tumors, both innocent and malignant, so rarely as to justify us in confining our attention entirely to the former.

The only true innocent neoplasm of the prostate I have so far personally discovered was an angioma, which was found accidentally in a post-mortem room specimen.

Sarcoma of the prostate is rarely met with. The Museum of Saint Bartholomew Hospital contains a specimen illustrative of this disease and by the courtesy of Dr. Andrews, I am able to show a drawing of it (Fig. 30).

According to Young's most recent statistics completed

FIG. 30.



Median sagittal section of bladder, prostate and rectum of a boy with sarcoma of prostate. (From the Museum of St. Bartholomew's Hospital by the courtesy of Dr. Andrews.)

FIG. 31.

Horizontal section of prostate removed by suprapubic prostatectomy, "total" enucleation showing carcinoma along with chronic lobular prostatitis (prostatic hypertrophy), and portion of prostatic sinus adherent.

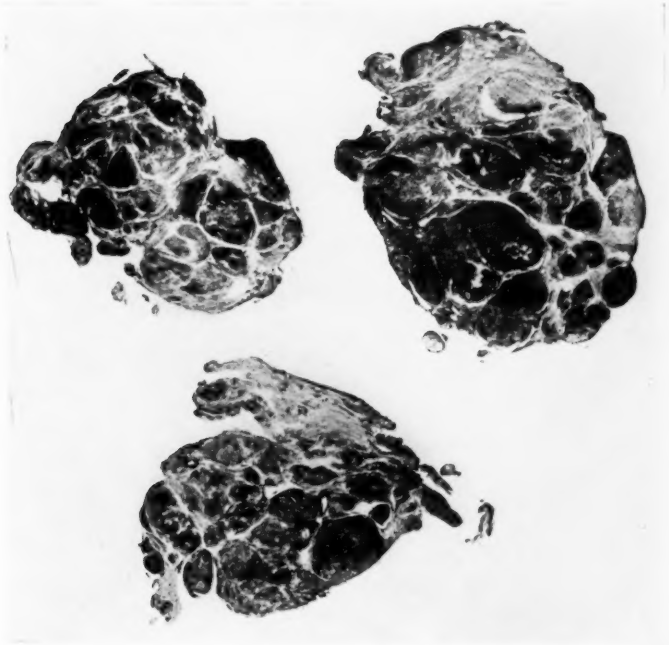
FIG. 32.

Horizontal section of prostate removed by suprapubic prostatectomy showing carcinoma along with chronic lobular prostatitis (prostatic hypertrophy).

FIG. 33.

Horizontal section of prostate removed by suprapubic prostatectomy showing scirrhus carcinoma.

FIG. 34.

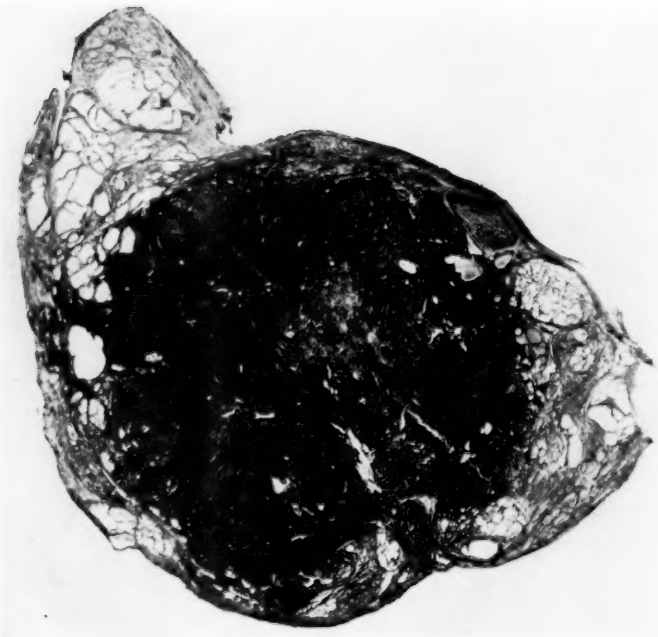


Sections of portions of prostatic carcinoma removed by the operation of suprapubic prostatectomy.

FIG. 35.

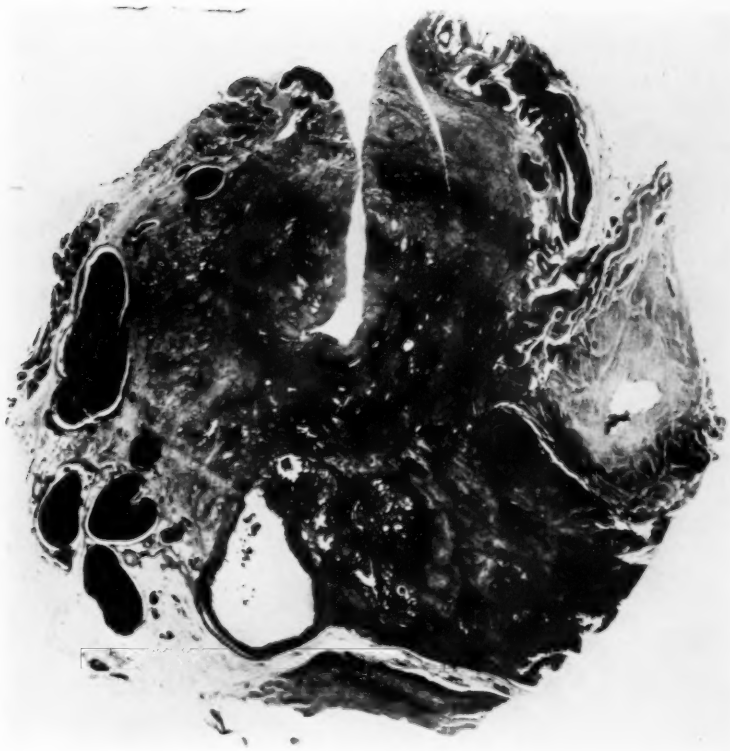
Section of one "lobe" of prostate removed by suprapubic prostatectomy showing chronic lobular prostatitis (prostatic hypertrophy). No signs of carcinoma.

FIG. 36.



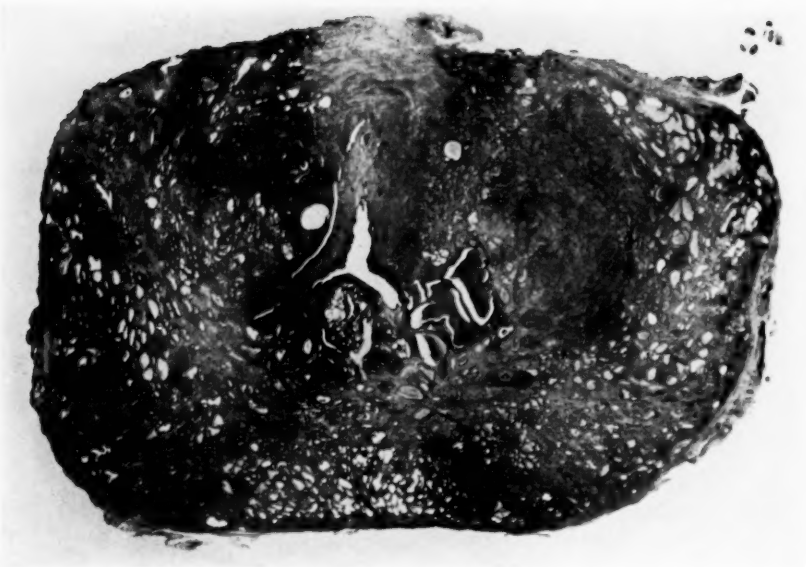
Section of "lobe" of prostate removed by suprapubic prostatectomy showing carcinoma along with chronic lobular prostatitis (prostatic hypertrophy). (Figs. 35 and 36 were from the same case, the tissue being removed in two "lobes.")

FIG. 37.



Horizontal section of prostate showing carcinoma infiltrating neighboring tissues implicating the vessels of the prostatic sinus and fixed to rectum.

FIG. 38.



Horizontal section of prostate removed by suprapubic prostatectomy showing early carcinoma and chronic lobular prostatitis (prostatic hypertrophy).

from cases in his own clinic, one case in five of prostatic enlargement causing obstruction in old men is due to cancer. Out of the 134 cases investigated that form the basis of this communication 14 showed carcinoma of the prostate to be present, or approximately one in ten.

The clinical records of fully an equal number of cases of cancer treated by palliative measures, the prostate not being removed, exist, but as no material was available for investigating the morbid anatomy, they are of course not included; but they go to further confirm the accuracy of Young's statement of the frequency of prostatic carcinoma.

In ten of the fourteen cases, prostatectomy was performed and in six of them chronic lobular prostatitis was also present; and had obviously existed antecedent to the onset of cancer, and probably predisposed to its development (Figs. 31 and 32).

Three types of carcinoma were found (Figs. 33 and 34): (1) Scirrhus; (2) medullary; (3) adenocarcinoma. They were very comparable to the types met with commonly in the female breast and showed a similar degree of malignancy, the last, like the adenocarcinoma of Halsted, being the least malignant. Wilson and McGrath have noted how carcinoma of the prostate is frequently only revealed on careful examination of the specimen after its removal by prostatectomy. In the ten specimens obtained by me from the operating theatre, this proved to be the case. They showed how fortunately at first it is the rule for the malignant disease to commence in the centre of an area of chronic lobular prostatitis, so that at first enucleation is rendered even more easy. Complete celloidin sections being made, they also showed how necessary it is to obtain a complete section for examination before a certain opinion can be expressed on the presence or absence of carcinoma.

In one case this was especially borne out (Figs. 35 and 36). The patient underwent prostatectomy, a "lobular" removal being carried out. Clinically, carcinoma was not suspected and the ease with which prostatectomy was accomplished combined with the speedy and uneventful recovery of the patient did not arouse the suspicion that cancer was present. On examining

the specimens, however, it was found that one "lobe" was the site of typical chronic lobular prostatitis (Fig. 35), while the other showed the same change, but in addition there was present in the centre of it a mass of carcinomatous new growth (Fig. 36).

The presence of this was borne out clinically eight months later when the disease recurred and led to the death of the patient from cancer.

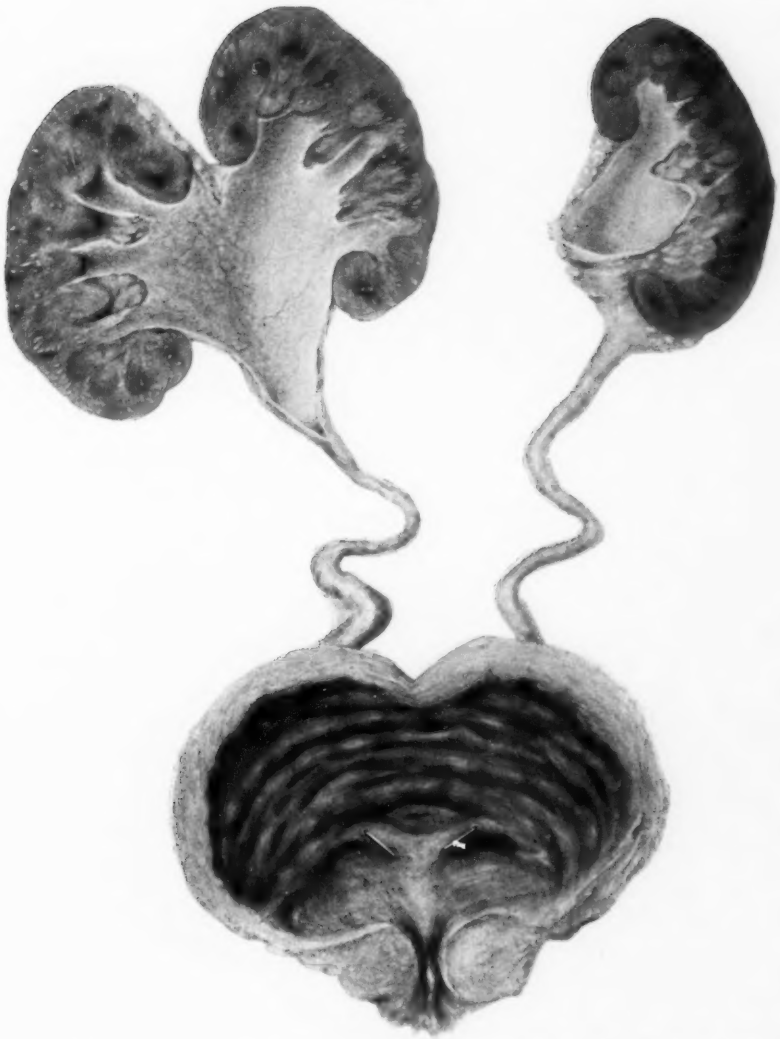
When carcinoma of the prostate has progressed beyond this early stage of centrally situated disease, one of three results may follow, when the operation of suprapubic prostatectomy by blind dissection is attempted, either the removal is accomplished with difficulty, a "total" prostatectomy being achieved (Figs. 31 and 38), or this being impossible, fragments of the diseased gland are extracted with difficulty, danger, and doubtful benefit to the patient (Fig. 34), or the disease is found to be so widespread, involving the adjacent blood sinuses and neighboring glands and consequently incapable of even partial removal (Fig. 37).

DURATION OF LIFE AND CAUSE OF DEATH IN UNTREATED CASES OF PROSTATISM.

Accurate observations on this most important question are difficult to obtain. We wish to know the general frequency of chronic prostatic disease, the duration of life in cases having absolutely no treatment and the causes of death in these. It is also important to possess if possible similar records of the fate of those who have led what is described as a "catheter" life. It has been already mentioned that Plondke has estimated that 33 per cent. of all men over fifty years of age suffer from enlarged prostate and that 10 per cent. of these require treatment and that, he also says, even catheter life results in a 100 per cent. mortality in an average period of four years.

In the absence of the necessary complete data accurate deductions are difficult; but we certainly know that the cases diagnosed early and treated early recover much more frequently than those where the opposite state of affairs holds

FIG 39.



Unilateral acute consecutive suppurative nephritis following prostatism due to chronic interstitial prostatitis. Showing numerous small abscesses in the kidney, hydronephrosis dilatation of both ureters and recent acute cystitis.

good. It is also a fact beyond dispute that pronounced prostatism causes a profound alteration in the genito-urinary tract above. The bladder becomes hypertrophied, dilated, and sacculated. The ureters and renal pelves are similarly dilated and hydronephrosis with pronounced renal atrophy occurs. I have also observed how even in early cases chronic interstitial nephritis is present, and am of the opinion that prostatism may act as a cause of this later change. When interstitial nephritis is present it certainly aggravates it.

In cases dying naturally of prostatism, two forms of death are observed. In one a sudden renal infection brings the patient to a surgeon under whose care he rapidly expires, with or without operative treatment, from acute consecutive suppurative nephritis. In these cases, the organism has usually entered the blood stream from a focus of infection in the lower urinary tract and been determined to the kidney, whose power of resistance to infection has been weakened by prolonged backward pressure. The accompanying illustration (Fig. 39) shows this condition. The patient was a laborer, who had suffered for three years from pronounced prostatic dysuria due to chronic interstitial prostatitis. He had received no treatment and when admitted to hospital was in a dying condition. The post-mortem examination revealed chronic interstitial prostatitis with backward pressure, recent acute cystitis and acute unilateral consecutive suppurative nephritis.

On the other hand, a slow renal destruction from persistent backward pressure may bring the patient within the care of the physician. The patient's loss of weight, persistent sickness and failing heart naturally lead to attention being directed mainly to the state of his cardiovascular system. The prostate is probably never mentioned by the patient and is occasionally unsuspected by his medical attendant as the primary cause of his illness and he dies, breaking up in a manner that is characteristic of so many medical ailments. It has been my experience to personally encounter two such cases of this nature. The most typical was that of a man who consulted

me with reference to the early indications of prostatism from which he suffered. It was a number of years ago, and he was in so excellent health at the time, that I considered it only honorable to dwell at considerable length on the risks of operative treatment for his enlarged prostate. This course I advocated strongly, but he declined and I lost sight of him for two years and a half, when I accidentally discovered him in a medical ward a physical wreck, dying from a failing heart, backward pressure and uræmic poisoning.

Some times such a case comes under a surgeon's care at a stage just prior to the final general breaking up. At this period, the appearance of the patient is sometimes most deceptive. His general health is stated to be good. The amount of urea present in the urine is diminished but to no excessive degree. The ordinary tests of renal functional activity when employed indicate a certain degree of renal insufficiency. Deluded by a fictitious appearance of general good health, the surgeon may operate, as was done in the case from which the accompanying illustration (Fig. 40) was taken and the patient dies, slowly sinking from no obvious and apparent cause or complication, and at the post-mortem examination, the ureters are found to be dilated to a size almost equal to the calibre of the small intestines, and the renal pelves are dilated to such an extent, that the parenchyma is reduced to a thin rim on the surface of two thin-walled multilocular sacs which are all that represent the kidneys.

During the post-mortem examination of patients who have died of various diseases in the medical wards of the hospital, there can frequently be observed, in male subjects over the age of 50 years, indications of a mild degree of chronic prostatic disease with associated damage to the urinary tract above. It is virtually always found that no complaint has been made of this by the patient. It is usually unsuspected, and has virtually never received treatment. In these cases, however, the ureter and renal pelves are dilated to a moderate extent and there is present a recent interstitial nephritis throughout both kidneys, and the renal parenchyma shows

FIG. 40.

Extreme backward pressure produced by prostatic hypertrophy. Note extreme dilatation of both ureters and renal pelves and extreme atrophy of renal secreting tissue.

indications of pressure atrophy through its substance. When the pathology of these cases is viewed by one with a surgical mind, it is impossible to avoid the conclusion that the renal destruction, as a result of the partial retention of urine from the prostatic disease, has contributed to a certain extent to lowering the patient's power of resistance to a general infection, or has poisoned the heart muscle by the retained products of metabolism which should be normally excreted by the healthy kidney.

THE SURGICAL PATHOLOGY OF THE OPERATIVE TREATMENT.

The mortality associated with the operation of prostatectomy is high. According to the published statistics of one of the largest hospitals in this country, out of 164 cases operated on during ten years 54 died, a mortality of 35.4 per cent. During the five years from 1906–1910, 69 cases were treated by suprapubic prostatectomy in Saint Thomas' Hospital. Of these, 14 died, a mortality of 20.3 per cent. According to Page, the mortality after the operation of suprapubic prostatectomy for adenomatous enlargement in the four London Hospitals of St. Bartholomew's, University College, Westminster, and Middlesex, during the period from 1906–1910 was 21.5 per cent.; 26 cases being operated on, of which 16 died. The mortality of the 1000 cases operated on by Freyer is returned by him at 5.5 per cent. In his first 100 cases, it was 10 per cent.; in his last 400, 4.5 per cent. In the last 100 there were only three deaths.

The operation of perineal prostatectomy has been especially practised in America by Young. In the last report of the International Association of Urology, he mentions that he has operated on 450 cases of benign disease by perineal prostatectomy, of these 17 died, a mortality of 3.77 per cent. These results, from the point of view of successful operations, appear to be the best in existence.

In the above-mentioned report, there is also contained the results obtained by a number of other experts and Rovsing's remarks at the above-mentioned congress are well worthy of

being referred to. He reported the result of 25 prostatectomies performed by himself for prostatic hypertrophy: 22 were suprapubic and 3 perineal. Three of the former died, a mortality of 13.6 per cent. and one of the latter, a mortality of 33.3 per cent.

His contribution to the discussion is of especial interest in that, in discussing the question of mortality, he mentions a point that must be in the minds of most of us, that the mortality of Freyer and Young which was returned at from four to five per cent. must not be taken as an indication of the general mortality throughout the world. He says. "We must not let ourselves be led into believing that this is the real mortality of the operation as regards the great number of surgeons; you will find a far higher rate of mortality from this operation in the wards of the large hospitals all the world over. In my opinion, this is not due only to deficient technic as compared with that of the specialist, perhaps, least of all so, but far more to the advanced stages of disease of the cases. The true mortality certainly cannot be estimated at less than 10 to 20 per cent."

We have observed when considering the pathology of those cases that died from prostatic disease without receiving treatment, how prostatism if untreated rapidly undermines the patient's health and power of resistance to infection, so that many patients are really in a dying condition when they come under the care of a surgeon.

Page has compiled from the statistical returns of Saint Thomas' Hospital, returns that form a most interesting comparison in this connection. He has collected the cases of prostatic disease that were admitted to hospital and tabulated these according to the variety of treatment they received. The total number of cases treated was 132 and the mortality over all was 21.7 per cent. Those treated by catheterization had a mortality of 22.7 per cent. Those treated by suprapubic drainage, a mortality of 20 per cent. and those by suprapubic prostatectomy a mortality of 20.3 per cent.

The value of these latter results is wherein they show the extent to which the patient's health was broken down prior to any surgical treatment, however simple, being adopted for the relief of the disease.

Those statistics showing the mortality attending the treatment of prostatism are not quoted by me to support the advocates of any of the alternative routes of operation employed and I do not ask that undue importance be attached to them. What to me appears to be of great moment is the fact that the mortality attending prostatectomy, as practised in general hospitals, has not shown in recent years that degree of reduction we might have been led to expect and what is of greater moment is that cases are occasionally seen that in the light of our present knowledge appear eminently to justify operative treatment. The operation proves simple and uncomplicated and still the patient dies from causes that would appear to be virtually unavoidable.

CAUSES OF DEATH AFTER PROSTATECTOMY.

From the records of Saint Thomas' Hospital, Page has constructed a statistical analysis of the cause of death after suprapubic prostatectomy, but space will not permit of my referring to his observations in detail. It is sufficient for our present purpose to mention that, of the 15 fatal cases examined by him, 10 died within a week of operation and the majority of these from an acute local infection or from acute suppurative nephritis. An analysis of the 68 fatal cases that have occurred in the hospital to which I am attached has given a very similar result and has gone to show that by far and away the commonest cause of death after suprapubic prostatectomy is septic absorption, arising out of the wound inflicted. And second, it has shown the fact, that the majority of cases of prostatism operated on in the wards of a general hospital are extremely bad lives from the actuarial stand-point on account of the pronounced degree of chronic renal disease from which they suffer.

THE LOCAL RESULT OF SUPRAPUBIC PROSTATECTOMY.

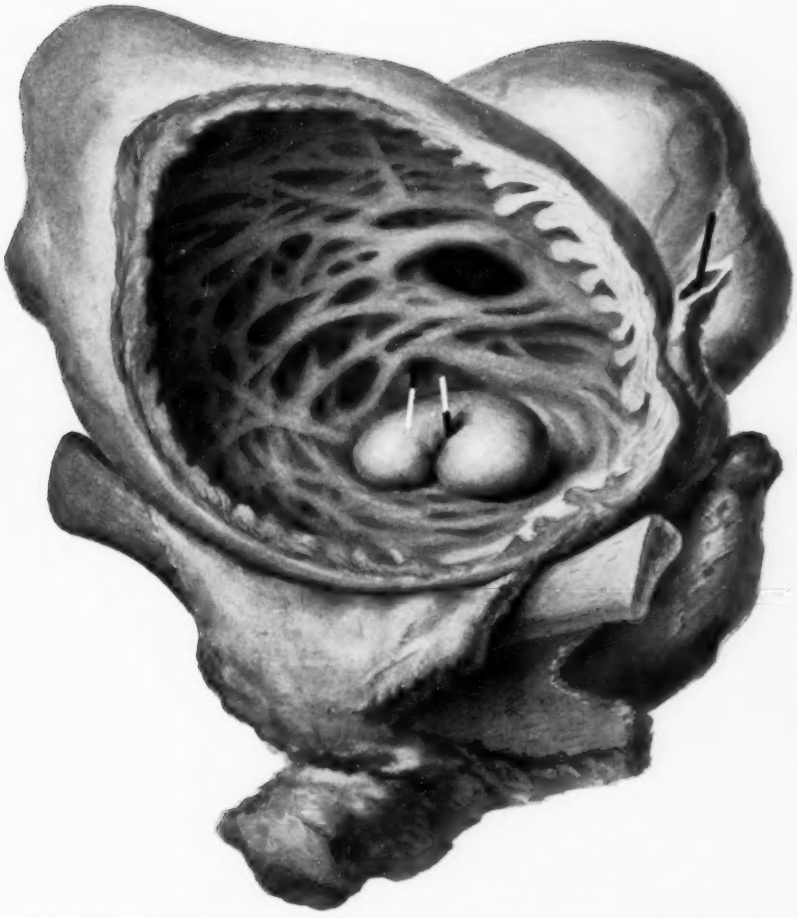
A considerable amount of discussion has centred round the questions, what is removed when suprapubic prostatectomy is performed and what remains of the gland after the operation is completed?

I would propose to show that the change produced in the prostate gland by the operation of suprapubic prostatectomy is determined mainly by the nature of the disease present in it. We will consider first the immediate consequences of Freyer's operation as performed for hypertrophy or chronic lobular prostatitis. When the operation is performed, the tissue removed is found to come away in one of four different methods: (1) "Total" enucleation along with the prostatic urethra; (2) "total" enucleation with conservation of the prostatic urethra; (3) lobar enucleation; (4) nodular enucleation.

1. *"Total" Enucleation with Removal of the Prostatic Urethra.*—Under this heading are included those cases where the mass of tissue is removed in one piece, and is traversed by the prostatic urethra which has also been removed. When the specimen is examined after removal, it is found usually to have a regular contour and to be coated with muscle fibres arranged concentrically around it. In appearance, it resembles the enlarged prostate gland, but when it is examined, it will be found that fortunately for the patient, "total" removal of the prostate gland has not been accomplished. In order to realize exactly what has been accomplished, the information gained in the operating theatre should be contrasted with the morbid anatomy commonly met with in cases of this disease, that have died without operation and compared with the features seen in complete sections made of the tissue removed and of sections made of the prostatic bed and adjacent viscera in cases that have terminated fatally after the operation.

It is the experience of every surgeon who has performed the operation of suprapubic prostatectomy on several occasions to note the ease with which the large "adenomatous" hypertrophied prostate is frequently removed. The thin mucous

FIG. 41.



Enlarged prostate forming intravesical projection. Note trabeculation of bladder from extreme muscular hypertrophy with diverticulum and dilatation of ureter.

membrane covering the mass projecting into the bladder is scratched through without difficulty. The line of cleavage is easily found. The finger sweeps readily round the mass of tissue which is enucleated with celerity and in comfort, being held for an instant only when the tough mucous membrane of the urethra is being torn through. The bleeding at the time is in no way alarming, and is soon naturally controlled. The cavity or prostatic bed out of which the tissue has been extracted contracts at once to a size approximately half of that of the structure it previously contained. The prostatic bed is felt to possess a smooth lining and the inner vesical sphincter can be made out as a muscular ridge between the bed below and the vesical cavity above.

When the morbid anatomy of such a case dying without operation is examined, it will be noticed how nature would here appear to have designed the parts for the performance of suprapubic prostatectomy.

The main bulk of the gland forms an intravesical projection covered by a thin and atrophied mucous membrane (Fig. 41). The internal vesical sphincter is dilated and crushed into a region of safety and surrounds the base of the intravesical mass (Fig. 21). Damage to it is virtually impossible.

The line of cleavage between the false capsule formed by the condensed uninvolved prostatic tissue and the diseased lobes is distinctly defined by the flattened and atrophied gland acini which form the ring of "postage stamp" perforations that have already been described in referring to the morbid anatomy of the disease (Fig. 23). The process being confined to the middle and lateral lobes, the ejaculatory ducts and posterior lobe are displaced into a region of safety and are separated from the area of hypertrophy by the thick-walled, false capsule. This latter membrane also serves as a thick protecting coat to the large blood sinuses lying between the sheath and true capsule (Fig. 24). The external vesical sphincter is also safe from any possible source of damage.

When the tissue removed in such a case is examined it will be noticed to possess the typical appearances of prostatic hyper-

trophy or chronic lobular prostatitis already described (Figs. 42–44).

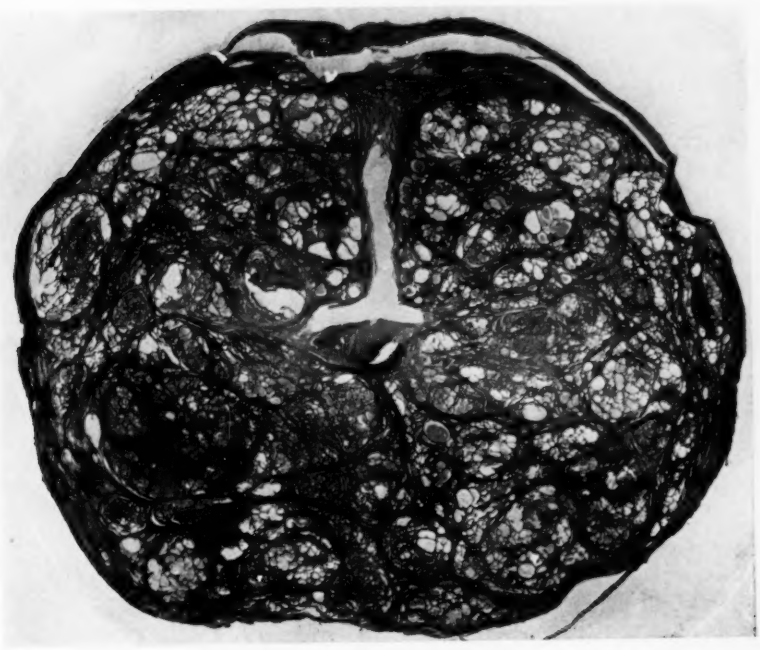
Serial sections never reveal the presence of the ejaculatory ducts within it or of striped muscle fibres coating the specimen.

A fatal issue may ensue even in such a case, however, and a further opportunity be afforded of observing what the operation accomplished locally. In order to investigate this latter question, I have studied the pathology of eight fatal cases following prostatectomy. The pelvic viscera were hardened *in situ* and thereafter complete celloidin sections of the prostatic bed and adjacent viscera were made and examined microscopically. For our present purpose, one typical case will be referred to.

The case was that of a man who suffered from typical prostatic dysuria from prostatic hypertrophy. The gland was extracted without difficulty. He died, however, on the fifth day from pelvic cellulitis, owing to infection through the space of Retzius. Fig. 45 is a vertical median (sagittal) section traversing the prostate and prostatic urethra which was removed. Fig. 46, a similar section of the prostatic bed left after removal. Fig. 47 is a composite superimposed photograph with the gland replaced within the cavity from which it was extracted by operation. Owing to the contraction of the cavity of the prostatic bed, the photograph of the prostate had naturally to be reduced in size to permit of this. When Fig. 46 showing the prostatic bed is examined, it will be noticed that the stretched internal vesical sphincter surrounds the upper vesical entrance to the cavity. The thick, smooth covering of the false capsule lining the space is visible. Microscopic examination shows this coat to consist of condensed prostatic tissue, consisting mainly of muscle fibres and fibrous strands with compressed and atrophied gland acini amidst the fibres. The ejaculatory duct is clearly shown traversing the posterior wall of the space from the seminal vesicles above. Below and behind the ejaculatory ducts, the compressed and atrophied posterior lobe is seen lying between the false capsule and space of Denonvillier.

The undamaged external vesical sphincter and recto-urethralis muscles are seen beneath the prostatic bed. Fig. 47, where the tissue is superimposed within the cavity from which it was ex-

FIG. 42.



Horizontal section of prostate removed by suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy), showing disease to be generalized and portions of false capsule.

FIG. 43.

Horizontal section of prostate removed by suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy) showing numerous thin-walled retention cysts where disease is advanced.

FIG. 44.

Horizontal section of prostate removed by suprapubic prostatectomy showing advanced chronic lobular prostatitis (prostatic hypertrophy) with numerous large retention cysts.

FIG. 45.

Median sagittal section, prostate, removed by suprapubic prostatectomy, "total" enucleation for chronic lobular prostatitis (prostatic hypertrophy). Note section traverses prostatic urethra and shows thin mucous membrane covering middle lobe.

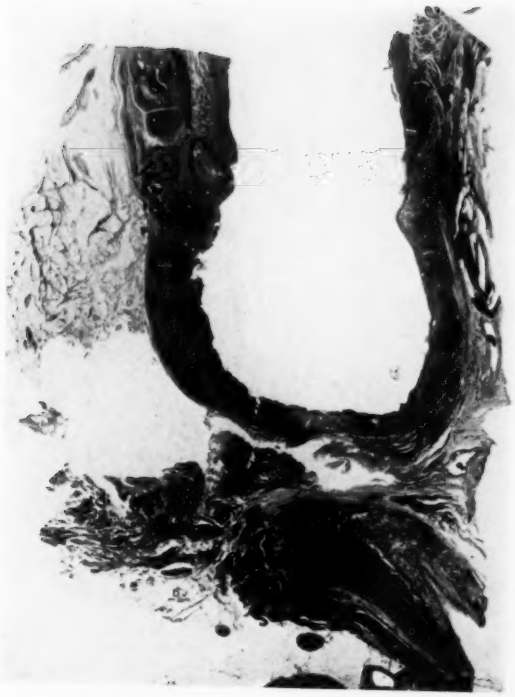
FIG. 46.

Median sagittal section of prostatic bed from patient dying on the fifth day after suprapubic prostatectomy, "total" enucleation, showing dilated internal vesical sphincter, thick false capsule, conservation of ejaculatory ducts, posterior lobe and external vesical sphincter. (Figs. 45 and 46 from same case.)

FIG. 47.

Suprapubic prostatectomy, "total" enucleation, superimposition photograph made from Figs. 45 and 46, the prostate being replaced within the prostatic bed.

FIG. 48.



Sagittal section of prostatic bed in midlateral plane showing situation and structure of false capsule lining prostatic bed and relationship of seminal vesicles and posterior lobe.

FIG. 49.

Lateral sagittal section from previous case, Fig. 46, showing margin of prostatic bed with nodules of diseased prostatic tissue within false capsule.

FIG. 50.

Lateral sagittal section from previous case, Fig. 46, showing prostatic bed containing nodules of diseased prostatic tissue within false capsule and relationships of internal vesical sphincter, seminal vesicles, and posterior lobe.

FIG. 51.

Horizontal section, prostate, removed by suprapubic prostatectomy for chronic lobular prostatitis (prostatic hypertrophy), showing partial conservation of prostatic urethra.

FIG. 52.

Horizontal section, prostate, the site of chronic lobular prostatitis (prostatic hypertrophy), showing nodular spheroidal nature of overgrowth and formation of false capsule. (P.M. Specimen.)

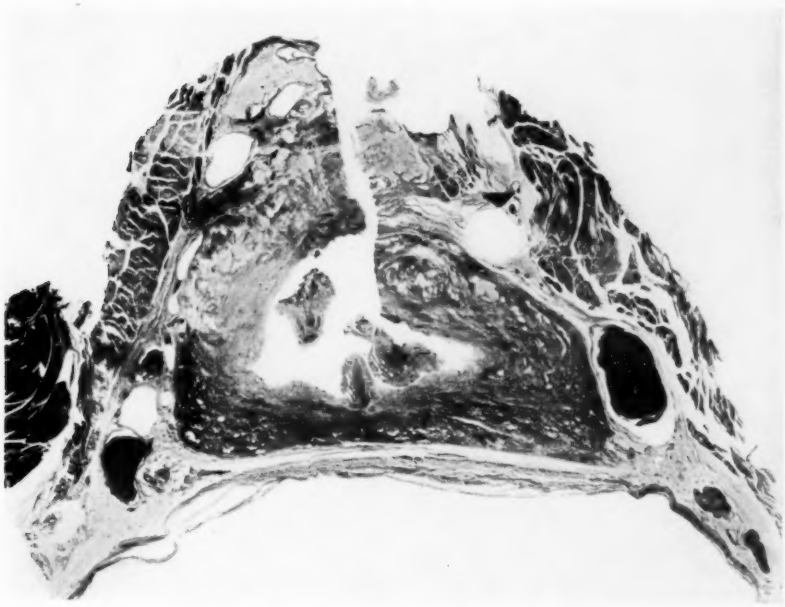
FIG. 53.

Horizontal section of prostatic bed, seminal vesicles, and rectum after suprapubic prostatectomy showing lateral wound in false capsule communicating with extracapsular lymph space. (Upper incision made at post mortem.)

FIG. 54.

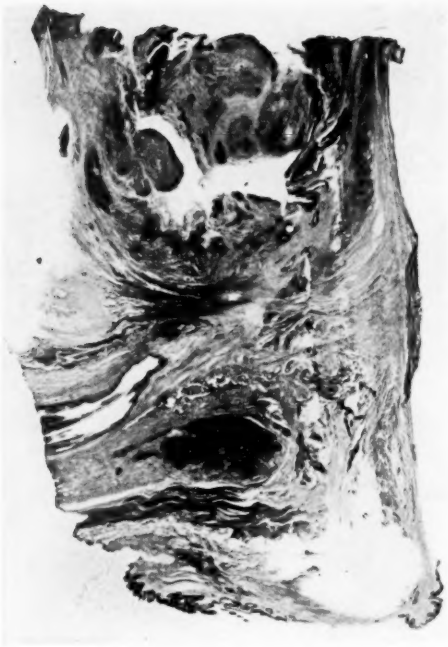
Horizontal section of previous case at lower level showing false capsule, posterior lobe and conservation of ejaculatory ducts.

FIG. 55.



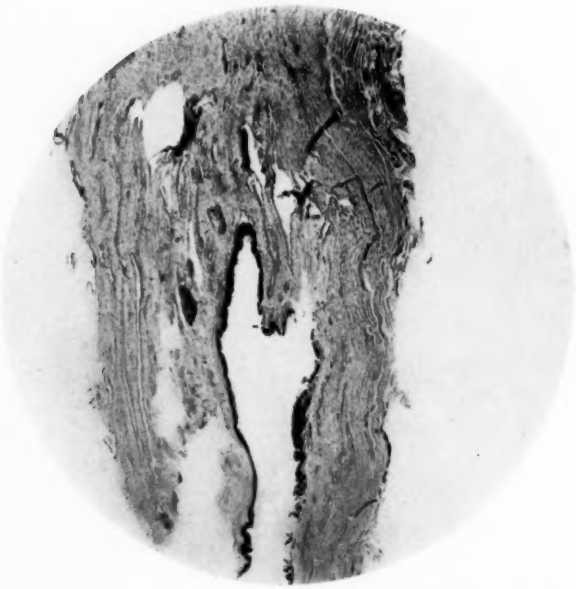
Horizontal section of previous case, showing prostatic bed, thick false capsule, posterior lobe and relationship of blood-vessels to prostatic sinus.

FIG. 56.



Sagittal section of prostatic bed, rectum and urethra after suprapubic prostatectomy showing false capsule and portions of tissue remaining after nodular removal.

FIG. 57.



Vertical section of tissue adherent to apex of prostate removed by suprapubic prostatectomy (Fig. 31), showing urethra and portions of external vesical sphincter.

FIG. 58.

Coronal section of lateral wall of prostatic bed after suprapubic prostatectomy, showing thick false capsule containing numerous septic thrombi.

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tracted, conveys in a manner more lucid than verbal description, the exact nature of the operation, where a "total" enucleation of the prostate gland is accomplished by the operation of suprapubic prostatectomy.

Even in the case above described, serial sections showed that, at the margin of the lateral lobes, nodules of diseased prostatic tissue had remained behind within the false capsule (Figs. 48–50).

2. *Total Enucleation with Conservation of the Prostatic Urethra by Suprapubic Prostatectomy.*—The determining factor in this operation is the consistence of the anterior commissure. Where there is situated in front of the urethra a mass of tissue tough in consistence and virtually devoid of disease, the finger is deflected naturally toward the urethra as it passes over the front of the gland and sweeps behind the urethra conserving it wholly or in part in consequence.

In such cases, it will usually be found that the lateral lobes are not widely involved in the disease which is mainly confined to the middle lobe.

Horizontal sections of specimens from such cases show a typical horseshoe contour (Fig. 51).

3. *Lobar Enucleation.*—The nature of the false capsule formed by the disease is the determining factor in such cases. In those cases where the morbid process is more lobar than lobular a thick false capsule surrounds the lobes and their separate enucleation is most easy and most likely to be accomplished (Fig. 22). The appearance in sections of the tissue removed is characteristic (Fig. 35).

4. *Nodular Enucleation.*—The nature of the false capsule is here again the determining factor in explaining the result achieved.

In discussing the morbid anatomy of prostatic hypertrophy or chronic lobular prostatitis, it was pointed out that the change that led to the formation of the false capsule surrounding the gland was not confined to that region, but took place in a similar manner between individual spheroids. In those cases where the tissue removed is extracted in individual nodules

of varying size, it will be observed that the external false capsule is imperfectly formed and the finger is in consequence deflected into the lines of separation that pass into the gland and separate the individual spheroids (Fig. 52).

It has already been mentioned that in addition to the case already described, the pelvic viscera of seven other cases that died after the operation of prostatectomy were hardened *in situ* and serial sections made of the prostatic bed and neighboring viscera. Certain of these illustrated some of the complications with which the operation may be associated.

Fig. 53 shows a traversed section of the parts left after removal and shows fragments of diseased prostatic tissue that have remained adherent to the false capsule, and illustrates how the false capsule had been lacerated at the time of operation and the space between the true capsule and sheath opened into. The effect of this was shown at the post-mortem examination in the large amount of extravasated blood that had infiltrated the pelvic cellular tissue, extending up over the posterior surface of the bladder into the retroperitoneal connective-tissue planes. The patient died from pelvic cellulitis, the infecting bacteria having gained entrance through the torn false capsule.

Sections from the same case (Fig. 54) at a lower level show the manner in which the ejaculatory ducts are conserved and come to open into the large prostatic bed. It also demonstrates the posterior lobe that remains after removal, lying between the ejaculatory ducts and the space of Denonvillier, and how in this case large parts of the lateral lobes were similarly uninvolved by the disease, and remained behind after enucleation.

A further section from this case made at a still lower level (Fig. 55) demonstrates the relationship of the blood-vessels in the sheath after prostatectomy, showing how they are protected by the thick layer forming the false capsule and the uninvolved prostatic tissue.

In only one of the eight cases examined were the ejaculatory ducts found to be seriously damaged. In five of the eight, the false capsule was torn and the pericapsular space infiltrated with blood and infected.

The appearances seen in one case, where a nodular removal was practised are illustrated in Fig. 56. Numerous fragments of diseased prostatic tissue have been left and are seen projecting into the prostatic bed. In such a class of case, it is not difficult to account for the liability for the obstruction to recur after the operation is recovered from.

Microscopical examination of the prostatic bed of the eight cases showed it to consist of muscle and fibrous tissue and compressed gland acini as already described and in all cases it was the site of an acute suppurative process. In all cases, small septic thrombi were present in the smaller vessels and in two cases large septic thrombi were also present in the large veins of the prostatic sinus (Fig. 58).

The question may now be considered whether a total extracapsular complete enucleation of the prostate gland is ever accomplished by blind finger dissection in the course of the operation of suprapubic prostatectomy. In certain anatomical text-books, the student is led to believe that this is what the surgeon aims at and usually accomplishes.

Thus, for example, the most popular student text-book of anatomy states:

> Immediately surrounding the prostate, and quite independent of the sheath, is the fibrous capsule of the prostate. This capsule varies in thickness, in some cases being extremely thin, in others forming a distinct cortex. In association with operations for the removal of the prostate now frequently performed, it is important to notice that the capsule has but very slight connection either with the venous plexus or with the sheath of pelvic fascia. It is on this account, that the gland can be so easily shelled out from its surroundings.

So far, I have only obtained one specimen of this nature. It was presented to me by a graduate, and in addition to the complete prostate, the seminal vesicles had been removed along with portions of the vasa deferentia, which hung like tentacles to the specimen. When the specimen was sectioned, it showed the gland to be the site of chronic interstitial prostatitis. I was informed that it was removed with the utmost difficulty. This was not surprising. No further history was obtainable.

Cases are, however, not rare where a partial extracapsular removal has been carried out. In the operating theatre, these are difficult cases, and when the specimen is examined after removal portions of striped muscle fibre are found on its surface, and a portion of one of the veins of the prostatic sinus may be adherent (Fig. 31).

From the lower apex of the gland, a tongue of tissue fre-

quently projects which contains muscle fibres derived from the external vesical sphincter (Fig. 57). These are usually either cases of diffuse chronic lobular prostatitis, where no spheroids are formed, or combined lobular and interstitial prostatitis, or, as in Fig. 31, cases of early carcinoma. The case from which this last specimen was obtained terminated fatally, and the post-mortem examination showed the false capsule to have been torn, and early secondary carcinoma present in the lymphatics.

I have not had the opportunity of examining post mortem a case of fibroid prostatitis treated by prostatectomy. If, in such a case, the prostate is enucleated, it is easy to deduce what is likely to result from what has been already described as the morbid anatomy of this disease.

THE LOCAL RESULTS OF PROSTATECTOMY—CONSERVATIVE PERINEAL OPERATION OF YOUNG.

In discussing the results of Young's operation, the surgeon has the advantage in that, he is afforded at the time of operation a full view of the dissection he executes, consequently, the same dubiety as to the structures divided and removed does not exist. The material examined by me was obtained from ten cases all of which were operated on by myself. When the tissue removed was sectioned and examined microscopically it showed the lobes to be masses of tissue, the site of chronic lobular prostatitis, and demonstrated the fact that the lobes were the product of no natural anatomical division of the gland but resulted from the separation of a common mass of diseased tissue into three more or less artificial divisions.

THE CHOICE OF OPERATION BASED ON THE PATHOLOGY OF THE DISEASE WITH ESPECIAL REFERENCE TO THE RELATIVE ADVANTAGES OF SUPRAPUBIC AND PERINEAL PROSTATECTOMY.

In discussing this question, we are met at the outset by the opinion already expressed when considering the pathology of certain " ideal " cases of advanced chronic lobular prostatitis,

where it was said that nature would appear to have designed the parts for the operation of suprapubic prostatectomy. We will therefore consider the question from three stand-points: (1) The factors contributing to the relatively high mortality met with in those "ideal" cases, when treated by suprapubic prostatectomy and how far it is possible to diminish this by the employment of other methods of operative treatment; (2) the local complication that may follow recovery after suprapubic prostatectomy in "ideal" cases of prostatic enlargement; (3) the danger of attempting to perform Freyer's operation of suprapubic prostatectomy in cases where the circumstances are not "ideal," the prostatism being due to other causes.

When the first question is considered, the facts concerning the cause of death after suprapubic prostatectomy already mentioned should be borne in mind. It has been already shown that the "ideal" case was the large "adenomatous" hypertrophied prostate, the site of chronic lobular prostatitis, where a large intravesical projection existed and a thick complete false capsule was formed. The damage to the patient's health during the period when this mass of tissue was ripening for removal has been also shown; the local and general irreparable damage caused by the prolonged backward pressure on the bladder and kidneys due to the retention of urine have been described. The case may be "ideal" for suprapubic prostatectomy, but the health of the patient has become so permanently impaired that any operation is now to him a most dangerous procedure.

The factors, that are liable to be the immediate cause of death in such a case have been shown to be (1) local infection arising out of the wound inflicted, for example, pelvic cellulitis, suppurative cystitis, consecutive suppurative nephritis and under this heading may be included also reactionary hemorrhage; (2) the development of a distal septic focus such as bronchopneumonia; (3) embolism, producing pulmonary infarction which is always due to an associated infection; (4) surgical accidents, such as fatal reactionary hemorrhage and

peritonitis; (5) uræmia. In cases, where the damage to the kidneys before operation was so severe, that, in the absence of other complications, this revealed itself as the sole cause of death.

The underlying cause, common to all, is thus the weakened power of resistance owing to the prolonged disease.

The dangers that are peculiar to suprapubic prostatectomy in an "ideal" case are the wounding of the space of Retzius and the consequent risk of septic pelvic cellulitis and the risk of pulmonary infection with hypostatic congestion and pneumonia that is present when an elderly patient is confined to bed for some time as is the general practice after suprapubic prostatectomy. The third risk is the difficulty of providing an efficient drainage of the bladder and prostatic bed so as to prevent a profound septic absorption from the stagnant septic urine that bathes the raw surface of the latter.

We may now ask how far these factors are avoidable by the choice of other means of treating the disease. The choice at our disposal lies between catheter life, the performance of a preliminary suprapubic cystotomy, and perineal prostatectomy. Catheter life may be dismissed at once as only justifiable in the hopelessly inoperable cases of this type. Preliminary suprapubic cystotomy is favored by some on the grounds that it permits of a certain improvement in the patient's condition prior to the removal of the growth and improves the condition of the septic bladder; but the value of it is doubtful. Page has shown how the mortality attending this line of treatment is relatively as great as that attending suprapubic prostatectomy and it has further this disadvantage, that it does not get rid of the main risk of the operation where suprapubic prostatectomy is performed in an "ideal" case, which is pelvic cellulitis due to infection by way of the space of Retzius.

A typical case is quoted below to illustrate this danger.

He was a man of sixty-seven, upon whom a suprapubic cystotomy was performed with the intention of its being preliminary to a suprapubic prostatectomy. On the night after operation, the

temperature rose to 103° and remained high for nine days, when it fell to 100° F. He complained chiefly of pain in the upper part of the abdomen, and died suddenly on the tenth day. The abstract of the pathological record is: Enlarged prostate, backward pressure, pyelitis, pelvic suppurative cellulitis, early bronchopneumonia. The detailed description of the pelvic viscera shows how the pelvic cellular tissue was infiltrated by a thick, greenish lymph which extended up into the retro-abdominal tissues. This area of purulent infiltration extended from the space of Retzius which had been wounded in the natural course of opening the bladder. The purulent infiltration reached as far as the lower pole of the right kidney. The prostate was increased in size, with a nodule of prostatic substance projecting into the cavity of the bladder behind the urethral opening and forming the so-called middle lobe of the prostate. This projection was covered with ulcerating bladder mucosa. The bladder wall was hypertrophied owing mainly to an increase in the muscular coat. The mucous membrane had undergone chronic ulceration and multiple villous-like projections of indurated mucous membrane projected from the surface. The ureters were somewhat dilated, their walls were hypertrophied, and their mucous membranes showed evidences of recent catarrh. The pelves of both kidneys were dilated and showed signs of recent acute catarrh. There was no evidence of suppurative nephritis; there was some chronic interstitial nephritis.

Where perineal prostatectomy according to Young's method is employed for the treatment of this "ideal" case it is of course associated with risks peculiar to itself, but with it there is naturally no risk of infection of the space of Retzius which is not damaged. The risk of pulmonary complications is much less, the patient being out of bed on the second or third day, and finally, every impartial critic will grant that where the technic of bladder drainage is carried out according to the directions laid down by Young, the drainage is as near "ideal" as is possible to achieve and there is no retention of stagnant septic urine in the bladder and prostatic bed.

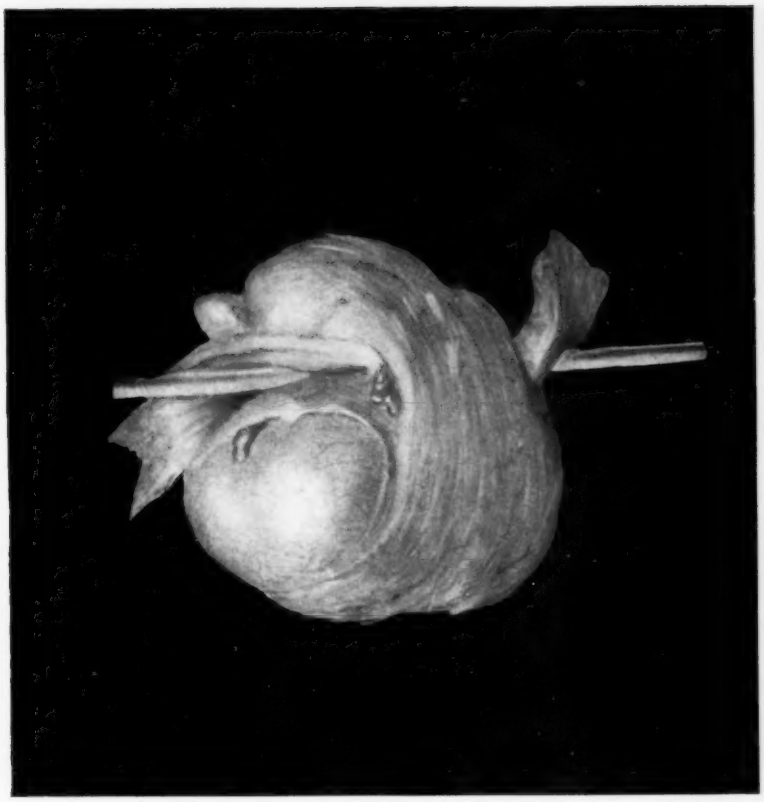
The unavoidable risks peculiar to Young's operation in such a case are the greater length of time occupied by the

operation and the risk of infection of the pelvic cellular tissue planes owing to the opening of the lymph paths when the space of Denonvillier is opened into. This latter would appear, however, to be more a theoretical than actual danger as it has not been encountered by Young in his numerous cases and in my very limited experience of ten cases it has never been encountered. The reason for this would appear to be that the time when infection is liable to gain entrance to the cellular tissue is during the hours immediately following the infliction of the wound before nature has had time to create the natural protective barrier, and during this period in Young's operation the bladder drain and gauze packs in the prostatic bed prevent the entrance of septic urine in such quantity as to lead to a cellulitis. When the gauze packs and bladder drain are withdrawn by the end of the second day the free dependent drainage prevents septic material accumulating. The importance of this latter fact appears to me to be borne out in my limited experience where I have noticed how liable such patients are to have a slight rise of temperature and other indications of ill health about the end of the first week after operation; at that period when the external skin wound is closing but still a day or two before the urine comes by the natural channel. During this brief interval Denonvillier's space is liable to be distended with septic material for the first time during the course of operation. This passing phase of septic absorption, if my explanation be correct, bears out the well-known surgical dictum, " That man does not die from sepsis on a free surface, it is the confinement of sepsis that the surgeon fears after operation."

The avoidable risks peculiar to perineal prostatectomy are probably more dreaded by certain surgeons. The reality of them no one familiar with the operation will gainsay. None of them are, however, such as to be likely to lead to a fatal issue.

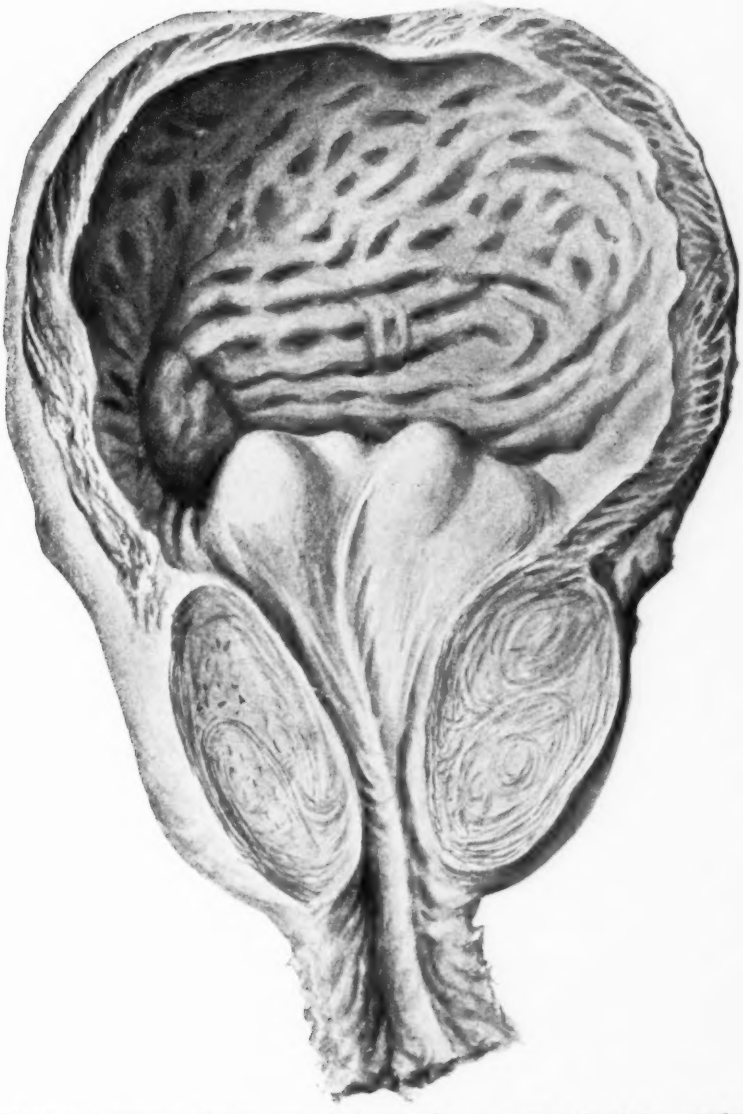
A " total " enucleation of the gland along with the prostatic urethra can, of course, be accomplished by perineal prostatectomy and blind finger dissection in the " ideal " case (Fig. 59). To accomplish this the integrity of the floor of the

FIG. 59.



Prostate removed by perineal prostatectomy, "total" enucleation along with prostatic urethra.

FIG. 60.



Bladder and prostate showing prostatic hypertrophy, intravesical herniation with displacement of internal vesical sphincter.

prostatic bed must be destroyed and Denonvillier's space with its contained lymphatics opened. This operation possesses those advantages that a perineal cystotomy does over a suprapubic cystotomy. Where a median incision is employed and the case found to be one that does not permit of the gland being enucleated by the unaided finger the surgeon may enlarge the wound and excise the gland by visual dissection. The operation has certain obvious disadvantages. The confined space necessitates a longer and more difficult operation. The external vesical sphincter of the prostatic bed must be damaged. Denonvillier's space is opened as an unguarded path of infection. The only advantage it possesses over Young's operation is a wound that is slightly smaller and an operation that is slightly more expeditious. On the other hand, the damage that may be produced by blind dissection in this region is necessarily very much greater than is the case where the dissection is executed by sight. On these grounds, I do not think it necessary to refer further to it as, where the perineal route is employed, Young's operation will be found in all cases to be the best to employ.

II. THE LOCAL COMPLICATIONS FOLLOWING RECOVERY AFTER PROSTATECTOMY IN "IDEAL" CASES OF PROSTATIC ENLARGEMENT.

The complications that are usually considered as liable to occur are:

(1) *Incontinence of Urine.*—This is considered to be especially liable to follow perineal prostatectomy. Young, however, has not had one case of complete incontinence after operation. He has had three cases of troublesome diurnal incontinence and four of nocturnal incontinence. It is considered as less likely to follow suprapubic prostatectomy and from what we have already seen such is naturally to be expected. McDonald in his analysis of the cases operated on in St. Peter's Hospital mentions three cases. In none did permanent incontinence remain. If suprapubic prostatectomy is combined with perineal drainage permanent incontinence may

develop. Fullarton has recorded such a case. The risk in such a case lies in the destruction of the dual sphincter that guards the bladder in a manner we have already seen. In citing those statistics, it is only fair to remember that many of the cases were not of the "ideal" type of disease that we are at present considering.

(2) *Return of Obstruction.*—This is usually due to incomplete removal of the disease and may develop in any case. Where the circumstances are ideal for suprapubic prostatectomy and the whole area of disease in consequence removed, the likelihood of this occurrence is most remote. It is, if anything, more likely to follow perineal prostatectomy in such cases.

(3) *Loss of Sexual Power.*—This is considered as especially prone to develop after perineal prostatectomy and is accounted for by the damage to the ejaculatory ducts. If these are conserved and the zone on the floor of the urethra and around the verumontanum preserved it can be avoided. This danger may be considered to be non-existent where suprapubic prostatectomy is performed in an "ideal" case. We have seen how nature in such cases carefully protects the ejaculatory ducts and verumontanum from damage. It is even claimed that the sexual vigor may be increased after suprapubic prostatectomy in certain cases and when the relief from pressure on the seminal ducts that follows the operation is realized, it will be apparent that this claim is quite rational.

(4) *Persistence of Vesical Fistula.*—This may occur in either operation. It is probably more common in the perineal operation.

(5) *Epididymitis.*—This would appear to be more common after suprapubic prostatectomy. McDonald examined 118 such cases, 14 of these suffered from epididymitis prior to operation, 27 developed it in hospital after operation. In 4 it arose after leaving hospital, a percentage of 27.75. The explanation of the relatively greater frequency of this complication in suprapubic prostatectomy would appear to be the less efficient drainage that is the rule with this operation.

(6) *Formation of Calculi in Bladder or Prostatic Pouch.*—This is a complication that occasionally arises. Its relative frequency after suprapubic or perineal prostatectomy is uncertain.

(7) *Recto-Urethral Fistula.*—This serious complication is especially liable to arise after a perineal operation. Its possible occurrence appears to have strongly prejudiced some surgeons against this route. It is by no means so common as is supposed. Young has observed it four times in 450 cases. Its prevention lies in a knowledge of certain anatomical relationships that have already been demonstrated.

The position as regards the operative treatment of the "ideal" case of prostatic hypertrophy due to chronic lobular prostatitis may therefore, be briefly stated to be that the simplest, most rapid, and, speaking broadly, the safest method of treatment is Freyer's operation. When it is performed, it is of the utmost importance that the skin wound should not be sutured so as to minimize the risk of prevesical infection. Efficient drainage of the bladder and getting the patient out of bed as early as possible are of equal importance.

Perineal prostatectomy in such cases, in skilful hands, may produce an equally good result, but is more liable to be followed by such post-operative complications as stricture, fistula, or partial incontinence. In the hands of those unfamiliar with the accurate steps of the operation and its after-treatment, it is a much more dangerous method of treatment for this class of case. Thus on practical grounds, we may reaffirm that nature would here appear to have designed the parts for the operation of suprapubic prostatectomy.

THE OPERATIVE TREATMENT OF CASES OF PROSTATISM WHERE THE DISEASE IS NOT IDEAL FOR SUPRAPUBIC PROSTATECTOMY.

We have seen how in this class there is included (1) cases of chronic lobular prostatitis or prostatic hypertrophy without glandular enlargement; (2) cases of chronic lobular prostatitis

without intravesical projection; (3) cases of chronic lobular prostatitis without the formation of a complete false capsule; (4) cases of chronic interstitial prostatitis where the disease is generalized, or has led to the formation of a median prostatic bar; (5) cases of carcinoma of the scirrhus type or involving the capsule.

The danger of attempting to perform Freyer's operation in such cases is known to every surgeon who has endeavored to do it. At the same time, it should be remembered that Freyer's position as regards such cases is perfectly clear. In speaking of cases suitable for suprapubic prostatectomy he says:

"In patients in the earlier stages of the malady in whom not more than an ounce or two is found on introducing the catheter, it is inadvisable to attempt the removal of the prostate because the enlargement of the organ will not have sufficiently advanced to render it prominent in the bladder or to define adequately the lines of cleavage between the true capsule of the prostate and its enveloping sheath. When we have to deal with adenomatous enlargements of smaller dimensions, say less than 1½ ounces in weight, the greatest difficulties present themselves as to the possibility of their enucleation entire being practicable."

It is important to bear in mind, however, in addition to early cases with a smaller quantity of urine the most pronounced cases of prostatism with the severest degree of backward pressure are frequently met with in cases where the prostate is not enlarged or only slightly so and where the gland in consequence maintains its normal relationship to the surrounding structure.

In treating such cases, therefore, the courses open to us are (1) to delay and wait for the gland to ripen to the maturity necessary for the satisfactory performance of suprapubic prostatectomy, a procedure surely unwarranted as a sound surgical practice in the light of the damage done to the urinary tract and the whole body by delay; (2) to endeavor to enucleate the gland by suprapubic prostatectomy; (3) to

seek in another operation a satisfactory means of treating such cases.

The risks associated with the second course where suprapubic prostatectomy is practised in the types of disease mentioned are numerous and have been already referred to. Thus, in chronic interstitial prostatitis and advanced carcinoma the operation is practically impossible. Its attempted performance is advised by no surgeon of standing, but, at the same time, cases have occurred where it has been attempted and I have referred to one where a complete extracapsular removal of the entire gland was achieved by this means. The dangers of such a procedure are too obvious to warrant repetition.

Where glandular hypertrophy without intravesical projection is present, it can of course be diagnosed by cystoscopic examination, or better still examined with an urethroscope, such as Wossidlo's, or a cysto-urethroscope. I am afraid, however, that in many cases, it is only when the bladder is opened that the condition is discovered. Suprapubic prostatectomy in such a case necessitates damage and probably destruction to the internal vesical sphincter. It is likely also that in these cases the line of cleavage between the area of disease and false capsule will be more difficult to find. The result is, the operation is much more difficult and the extracapsular lymph space will probably be opened into and the grave risk of septic pelvic cellulitis encountered in consequence.

There remains last the case where the false capsule is imperfectly formed, to be considered. I claim to have already shown that these cases are occasionally met with and we have seen how when suprapubic prostatectomy is done in such cases the tissue is removed, usually in fragments with the risk of leaving portions as possible future causes of obstruction. In this class of case again the dangerous lymph area between the capsule and sheath may be opened into.

We may, therefore, consider that in all the classes of cases mentioned Freyer's suprapubic prostatectomy is unsuitable.

III. THE OTHER OPERATIVE PROCEDURES SUITABLE FOR THESE CASES.

Those comprise (1) perineal prostatectomy; (2) division of the median bar by Bottini's galvano-cautery, or its modifications, or by Young's more recently introduced prostatic punch; (3) suprapubic transvesical prostatectomy by the transperitoneal route or extraperitoneal with visual dissection.

The scope of the second variety of operative treatment where the cautery or punch is used is clearly defined. They are the procedures of choice for cases of chronic interstitial prostatitis, especially with median bar formation.

Perineal Prostatectomy.—Cases of chronic lobular prostatitis (prostatic hypertrophy) without glandular enlargement are particularly suitable for this operation. In this type of disease, the false capsule was well formed in the cases I have examined. The entire gland, however, is situated below the bladder floor and separated from that cavity by its mucous and muscular coats.

By means of the operation of perineal prostatectomy, if properly executed, the area of disease may be entirely removed without damage to the internal or external vesical sphincters. If, at the same time, the surgeon, following Young's instructions, cuts deeply into the individual lobes by the incisions made parallel to the course of the prostatic urethra the compressed tissue of the posterior lobe will be divided and the line of natural cleavage reached that allows of the easy removal of the diseased tissue in the separate portions described as lobes by Young. It has appeared to me that the importance of making this incision of a necessary depth in all cases where Young's operation is performed, so that the posterior lobe is divided completely, is perhaps not always fully appreciated when this operation is performed and it is rendered much more difficult in consequence owing to the natural line of cleavage not being reached by the shallow cut made.

Where perineal prostatectomy is done for cases of chronic

lobular prostatitis with general enlargement without intravesical projection or with an imperfectly formed false capsule the dual sphincter can always be conserved. The absence of the false capsule will of course render the removal more difficult, but as this is an operation whose technic is that of a visual dissection and not a blind finger enucleation, as in the suprapubic operation, this difficulty is not anything like so serious. Further, the wounding of the extracapsular lymph space which is liable to occur and was referred to as a serious complication in the suprapubic operation is not here of serious consequence, because, owing to the reasons already given, the space is not liable to the same degree of septic infection and the drainage it receives is so thorough as to mitigate against the risk of cellulitis arising from this cause. If the large veins beneath the sheath are wounded the bleeding vessel can be seen and controlled by ligature and serious hemorrhage thus prevented.

The treatment of carcinoma by perineal prostatectomy has been shown by Young to be possible even in those cases where the capsule and base of the bladder are invaded. If the tumor is adherent to the rectum behind, the risk of damage to the bowel is correspondingly very much increased. Young has removed the entire gland along with the seminal vesicles and a portion of the bladder floor, a procedure impossible by the suprapubic route. It is only fair, however, to remember when considering the treatment of prostatic carcinoma that in many cases the disease when early has been removed with ease by Freyer's operation. This has, however, been accomplished when the malignant nature of the growth was clinically unsuspected and, usually, owed its success to the co-existence of chronic lobular prostatitis, upon which the malignant process had supervened. This latter fact is a further reason for advocating early operative interference in all cases of prostatic dysuria and it does not directly influence the question of the treatment of the disease when clinically recognizable. I think most will agree that in the light of the pathology of prostatic carcinoma and the results obtained by Young, Willan's advice as given in his

recent article is unduly pessimistic, when he recommends that where a diagnosis of cancer of the prostate has been made clinically the performance of a radical operation for the removal of the disease is not to be recommended. When 20 per cent. of cases of prostatic enlargement or obstruction in old men are recognized as due to carcinoma such advice is surely unwarranted.

Suprapubic Transvesical Prostatectomy by the Open Method.—This method of treating prostatic disease is being more generally practised in recent years. It is possible that when visual accurate dissection has replaced blind enucleation an "ideal" operative technic for the treatment of the above varieties of prostatic disease may be elaborated by this route.

Accurate removal and perfect control of hemorrhage would thus be possible. On the other hand, however, it is obvious that if the route is transvesical it must necessitate serious damage to the bladder in many cases to reach an organ that is frequently entirely extravesical in situation. How far this can be made good by reparative plastic surgery as a final procedure in the technic of such an operation can only be conjectured.

The conclusions as regards the treatment of prostatism from the stand-point of the pathology of the diseases causing it appear to me to be:

1. Three outstanding varieties of disease lead to prostatism: (*a*) Prostatic hypertrophy or chronic lobular prostatitis; (*b*) prostatic fibrosis or chronic interstitial prostatitis; (*c*) prostatic carcinoma.

2. The first is by far the commonest cause of prostatism and was present in 82 per cent. of the specimens examined.

3. Chronic lobular prostatitis is in my opinion a senile hyperplasia, an aberrant overgrowth of tissue that is not the result of the appearance of an independent new growth, but is liable to develop into the same.

4. Chronic lobular prostatitis in the majority of cases produces prostatic hypertrophy.

5. It virtually always develops in the middle lobe and is almost uniformly confined to the middle and lateral lobes.

6. The gland in consequence undergoes changes that usually permit of its easy removal by suprapubic prostatectomy.

7. Chronic lobular prostatitis may develop in and be confined to the anterior lobe, this being noted by me in one case.

8. Chronic lobular prostatitis may cause prostatism without enlargement of the organ, intravesical herniation or complete false capsule formation.

9. In these cases the performance of suprapubic prostatectomy is difficult and dangerous.

10. The successful performance of suprapubic prostatectomy depends on the presence of an advanced type of prostatic hypertrophy due to chronic lobular prostatitis.

11. The recognition of this is clinically frequently very difficult.

12. When a patient with this advanced type of disease is operated on his urinary tract and general health have usually suffered serious damage from the disease.

13. It is therefore unjustifiable to delay operation in an early case of chronic lobular prostatitis in order to permit of the gland undergoing those hypertrophic changes that facilitate its easy removal by suprapubic prostatectomy.

14. The mortality attending suprapubic prostatectomy is mainly due to the impaired health of the patient prior to operation.

15. The actual cause of death in such cases is usually a local infection arising out of the wound inflicted.

16. The operation of suprapubic prostatectomy by blind enucleation is unsuitable in cases of prostatism due to other causes than advanced chronic lobular prostatitis.

17. Perineal prostatectomy is a most suitable operation for such cases.

18. Perineal prostatectomy permits of the removal of the disease when its presence is diagnosed in all cases. It is, therefore, at present the operation that offers the best prospect of further advance in the treatment of prostatism.

19. For its successful performance an accurate knowledge of the anatomical structure and relationships of the prostate are necessary as well as an understanding of the pathology of the disease.

20. The suprapubic transvesical method of prostatectomy by visual dissection offers the prospect of developing into a method of treating prostatism that may ultimately warrant its adoption in a large number of cases.

21. Chronic interstitial prostatitis is best treated by division and removal of the constriction by the transurethral route.

22. Prostatic carcinoma may be in an early case clinically indistinguishable from hypertrophy due to chronic lobular prostatitis.

23. This fact is therefore a further reason for early operation in all such cases.

24. Prostatic carcinoma when recognized clinically may be successfully treated by excision of the gland in suitable cases.

I desire to record my gratitude to the President and Fellows of the Royal College of Surgeons of Edinburgh, in whose laboratories this research was conducted.

I wish to thank also many of my senior colleagues, and especially Mr. David Wallace, for permitting me to use material from their private and hospital cases, and Dr. Shennan and the staff of the Pathological Department of the Royal Infirmary of Edinburgh, for the many willing services they have done for me in the course of this investigation.

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SUPRAPUBIC VERSUS PERINEAL PROSTATECTOMY.*

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For relief from distressing symptoms and imminent peril, few operations can rival the successful removal of the enlarged prostate obstructing the urinary outlet. The dangers and disadvantages of catheter life are well understood. The average expectancy of life for those entirely dependent upon the catheter has been estimated at two and a half years. Squier has recently reported 17 cases in his own observation who were dependent upon the catheter. Of these, 14 had died with an average duration of life of two years and ten months after commencing catheter life. Twelve of these died from suppurative renal lesions.

This only bears out the fact that catheterism, even as performed at present in the full knowledge of the dangers of infection and the means of prevention, is an exceedingly risky state and should cause us to ask the sharp question whether the man who still advises the catheter in this condition should be ranked truly as a conservative or as a dangerous radical. Even granting a mortality of four to ten per cent. in the operation of prostatectomy, the average expectancy of life under operation greatly exceeds three years. Freyer recently had the satisfaction of seeing three of his first four cases of complete prostatectomy alive and well at the end of eleven years. The great difficulty with the catheter life is the possibility, in any but the exceptional case, of observing the necessary precautions to prevent infection of the bladder.

The cleanest catheterization *may* result in bladder infection;

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dirty catheterization *is almost certain* to do so. In spite of all this cases are known to have lived for 15 to 20 years or more after beginning the use of the catheter. These are the exceptions which prove the rule. I have now a case under observation who has complete retention of urine. He is a man over seventy-five years of age, and otherwise in robust health. Since his first attack of complete retention fifteen months ago, he has been entirely dependent upon an indwelling catheter which is changed once a week. He suffers practically no inconvenience, urination being at normal intervals and controlled during the meantime by a cork in the catheter. The catheter is replaced each week by a physician, the greatest care being exercised to prevent the introduction of infection. The bladder is irrigated once a week with a solution of protargol. For anyone who has a urethra tolerant to a permanent catheter as well as the time, means and patience to carry out this treatment this appears to be as safe a form of catheter life as can be devised, though the time is yet too short to say that it has fully justified itself and in any event, such scrupulous care is beyond the range of possibility for the average patient. It is much like the rich man with duodenal ulcer or gall-stones. He can carry out the rest treatment or visit Carlsbad and take the Sprudel for nine medical cures before coming to the knife, while his less fortunate brother will be obliged to consult the surgeon at once.

Only a little over twenty years ago no one had removed or attempted the surgical removal of the entire prostate. A fair number of sporadic attempts had been made to remove the obstructing portion of the gland. In the earliest surgery of the prostate the acute question arose as to the best route of surgical approach. Belfield in America, Dittel in Germany and McGill in England, succeeded in partial prostatectomies through suprapubic incisions. Ferguson, Billroth and Gouley accomplished the same result through the perineum. I well remember Dr. Agnew in a discussion upon the relative merits of the suprapubic and perineal approaches to the bladder expressing his belief picturesquely by saying that "he never

could see the philosophy of breaking through the roof of a house when you could get in through the cellar door."

At about the same time, approximately twenty years ago, Goodfellow (1891) performed the first total perineal prostatectomy and Eugene Fuller (1894) removed the gland entire by the suprapubic incision. The immediate importance and success of complete prostatectomy intensified the strife as to method, the choice of route being the most discussed feature of the operation and in many cases, we fear, almost overshadowing the results of the operation itself. We are only now beginning to get the necessary perspective by which to value the operation and the various methods of its performance. We can discern three distinct swings of the pendulum, first, toward the suprapubic operation, second, toward the perineal route, and now again a very decided trend almost everywhere toward the suprapubic approach. Set over against each other as the protagonists of the two extremes we find Freyer, of London, confining himself to the suprapubic operation and Young, of Baltimore, adhering equally rigidly to the perineal method, the success of which owes so much to him in his development of the earlier methods of the Frenchman, Proust.

The most important single criterion by which an operation is to be judged is mortality. "All that a man hath will he give for his life." The safest surgery compatible with the attainment of the necessary object is the best surgery. If it can be shown that one or the other of these two rival operations possesses an undoubted superiority in the matter of safety then certainly the claims of the more dangerous operation must fall to the ground since it is conceded that the prostate can be enucleated by either method. The advocates of perineal prostatectomy have not been slow to take advantage of the mortality argument. Young's mortality in the latest report which I have seen was slightly over 4 per cent. Freyer in 1912 reported 1000 suprapubic operations with a total mortality of 5½ per cent. Examining these statistics more carefully we find that Freyer was able to report in his last 100 cases only

three deaths, or a mortality of 3 per cent. Young at one time was able to report over 200 cases with a mortality of less than 3 per cent., but since then additional failures have raised the average until at the present time I believe it is fair to say that the mortality of the two operations, in the hands of their foremost exponents, is as nearly equal as it is possible to expect. Freyer was earlier in the field when the important factors of preliminary and after treatment were not so well understood as is shown by his earlier mortality of 10 per cent. for the first hundred cases. The combined statistics of operators throughout the world show a greater mortality for the suprapubic operation than for the perineal. Against this we must set the fact that the suprapubic operation is undoubtedly the easier and is therefore more often chosen by the operator of less experience. Also in the case of surgeons who perform both operations the easier is more likely to be chosen in desperate cases when a minimum of anæsthesia and manipulation is desired and in cases complicated by stone, which are admittedly subject to higher mortality.

In short it is my conviction, based upon personal experience and examination of the results of others, that the mortality of the two operations *per se* is approximately equal and that the factors influencing mortality are less to be sought for in the operation itself than in extraneous conditions, the most important of which are (1) the selection of the patient, either conscious selection on the part of the surgeon or unconscious, owing to the character of his practice; (2) to the preliminary preparation of the patient for operation; (3) to the skill of the operator, and finally, to rational after-treatment.

Second only to the mortality of operation is the question of the result of operation. Indeed, so wretched may be the condition of patients of this class either without operation or after an unsuccessful or complicated operation that the result may be said at times even to outweigh the question of life or death. Before the present era of comparatively satisfactory treatment of prostatism it was remarked by some one that the

victim of enlarged prostate often came to regard his last day as the best day of his life. Factors destructive of success in the restoration of function by operation are (1) incomplete removal of the obstruction, (2) the introduction of some other source of obstruction as a sequel of the operation itself, (3) loss of voluntary control of the bladder, (4) injury to the rectum, (5) persistent urinary fistula, (6) failure to recognize and treat complicating conditions, such as vesical calculus, (7) loss of sexual or procreative power in those who are still potent.

In the hands of competent operators incomplete removal of the obstructing organ is uncommon. With the suprapubic operation it is more difficult to leave behind an offending portion of the organ than by the perineal route. The portion of the prostate which most often causes trouble is most easy of access from above and is the portion first attacked and most certain of removal. The prostate is, in the vast majority of cases, removed entire, whereas in the perineal operation morcellation is more common and the most dangerous portion of the obstruction is the deepest seated, away from the eye and more likely to escape detection. While there are some who argue that the prostate is never entirely removed and that there is always some prostatic tissue left behind in the capsule, this does not make any particular difference as long as the patient gets well. Personally, I know that in all adenomatous prostates operated by the writer that the organ has been removed entire, with all due respect to the gentlemen who argue to the contrary. Squier reports a case in which a small portion of prostate was left by perineal prostatectomy, defeating the result of the operation and requiring suprapubic removal.

Occasionally the operation in removing the prostatic obstruction introduces some other obstructive element. Stricture of the damaged urethra or vesical outlet has been known to occur. In the perineal operation stricture is more likely to occur because of the traumatism to the membranous urethra. This portion of the urethra is not touched in the suprapubic

operation, but in perineal prostatectomy it is opened for the passage of the prostatic tractor in the case of Young's operation, or for the finger in the case of those who perform intra-urethral enucleation. A stricture of the lower urethra is more embarrassing to deal with than the contractions which occasionally occur in the prostatic portion, a complication to which the perineal prostatectomy is as liable as the suprapubic. In two cases of suprapubic removal I met with a complication requiring a second operation. This was obstruction of the urethral outlet by a flap of the torn mucous membrane made in the enucleation of the gland. Recovery was complete in both cases after excision of the flap of mucous membrane acting as a valve at the vesical orifice of the urethra.

Loss of voluntary control of the bladder after prostatectomy is an extreme disappointment to the patient inasmuch as it leaves his last state worse than his first. Here there is a very decided advantage in favor of the suprapubic operation. Voluntary control of the bladder is vested chiefly in the compressor urethræ muscle (external sphincter muscle), but partly in the internal sphincter (the aggregation of circular muscular fibres of the bladder at the vesical neck). It is obvious that any dissection of the perineum may occasionally inflict damage upon the compressor urethræ muscle or its innervation as well as upon the internal sphincter muscle, particularly through prolonged traction with a perineal tractor. On the other hand the compressor urethræ is in practically no danger in the suprapubic operation. The prostate lies entirely above the triangular ligament and it must be a very exceptional case or a very bungling operator that would injure the muscle, protected as it is by the triangular ligament.

The rectum is even more likely to be seriously injured than the compressor urethræ in the perineal operation. At the apex of the prostate and in relation with the membranous urethra, the rectum is held strongly forward by the recto-urethralis muscle and in some cases is almost directly applied to the urethra. The greatest care in dissection and the utmost gen-

tleness in handling is thus necessary to prevent wounding the bowel. No operator of large experience in perineal work has avoided this complication. Post-operative infection or pressure necrosis also have caused the rectum to be opened secondarily even when it was left intact by the dissection. The result of such an accident at best is perineal suppuration, protracted convalescence and often a rectovesical fistula. I have injured the rectum in perineal prostatectomy but never in the suprapubic operation, except in one small carcinomatous prostate with periprostatic inflammation, a case which should not have been operated on by the suprapubic method but by the perineal, if operated at all. This is the general experience and constitutes a valid criticism of the perineal approach.

The anterior fibres of the levator ani are attached to the sides and under surface of the posterior sheath and are likely to be injured to a degree, at least, in perineal enucleation, while not so in the suprapubic. The levator ani, like the voluntary muscles of the abdominal wall, assist in emptying the bladder, consequently it is important in any operation to inflict as little injury to the surrounding tissues as possible.

The urinary fistula left after both types of operation fortunately heals very kindly in the great majority of instances. It is well known, however, that suprapubic vesical fistulæ are more likely to close spontaneously than fistulæ in the perineum. In the suprapubic operation the course of the urethra is not disturbed, while in the perineal operation it is opened in order to gain access, either with finger or instruments, to the bladder. It is inevitable that such trauma of the urethra will at times result in stricture or fistula. I cannot but feel that this sequel is not as cheerfully acknowledged as should be by the perineal operators when it has occurred to me within a comparatively short time to have observed instances of persistent perineal urinary fistulæ, loss of control of the power of urination, the patient wearing a rubber receptacle tied to the thigh, coming from the hands of a man most prominently identified with peri-

neal prostatectomy whose writings would lead one to minimize, if not to dismiss altogether, this annoying sequel.

Partial or complete loss of voluntary control is by no means unheard of after the perineal operation while after the suprapubic operation it is certainly a most unusual sequel, if it occurs at all. I have had two patients who underwent perineal removal recently consult me for this unfortunate condition.

There is much less chance of failing to recognize intravesical conditions, particularly calculus, encysted stone and diverticula, with the bladder open for inspection by the suprapubic incision. Direct vision is preferable to even the most satisfactory cystoscopy. When I employ the suprapubic incision, unless the diagnosis is questionable, I rarely use a cystoscope, as I believe it is to many a marked addition to the burden of discomfort and unfavorable shock that they are called upon to endure. Exposing the interior of the bladder to the light of day dispels any mystery and reveals the truth.

Much stress has been laid upon the preservation of the sexual powers by Young's method of leaving the ejaculatory ducts. In many cases it makes little or no difference whether the operation be designed for this end or not, as the sexual powers have long since waned. In the minority of cases, other things being equal, it is desirable to employ the operation which is most likely to preserve this function. The only possible attitude of mind at the present time is a judicial one, as exact data are not sufficient to determine the point. I formerly thought that I tore away the ejaculatory ducts in practically every complete suprapubic prostatectomy. Later observations have convinced me that in many cases they are left behind. Even when they are torn off the sexual appetite, erection and orgasm may be preserved though ejaculation is either abolished or occurs into the bladder. Legeve and Papin have collected from the literature exact observations on this subject in cases after suprapubic prostatectomy. They conclude that erection is conserved in the vast majority of cases and that the orgasm is ordinarily preserved. It is my opinion that the

careful avoidance of the ejaculatory ducts by the perineal operation of Young presents little if any sexual advantage over the end results of suprapubic prostatectomy save in the preservation of ejaculation, a point only to be considered in the few cases of procreative age.

The factor of dependent drainage urged in favor of the perineal incision is, I think, of little moment. A large, well-placed suprapubic tube will keep the bladder as dry as the perineal drain, as there is always a puddle in the prostatic bed below the eye of the perineal catheter or drain.

Infection of the suprapubic space is a point against the high operation, as it is more likely to occur than perineal infection. It is my practice to guard against this by closing the lower end of the wound very loosely and passing a wick of gauze or piece of rubber dam down to the loose cellular tissue of the prevesical space.

I yield in my preference for the suprapubic operation (1) in cases of carcinoma when lines of cleavage have been obliterated; (2) in tuberculosis of the prostate; (3) in the small sclerotic prostates of chronic prostatitis or fibrous hypertrophy. All of these groups I rarely operate upon and only upon the strongest indications. When it is necessary to do so the perineal technic as employed by Young is the operation of choice.

In all prostatic work, as well as in major surgical work in general, careful selection of the time for operation is the most important element in success. The functional capabilities of the heart and kidneys must be carefully estimated before operation is attempted. In the estimation of the kidney function I lay most stress upon the twenty-four-hour amount and specific gravity, paying less attention to the chemical and microscopical analyses. Naturally, the presence of sugar, albumin in large amount, or excessive number of casts indicate caution. But inasmuch as the secretory powers of the kidney are the chief factors in the prevention of uræmia, the most common cause of mortality, it is upon the evidence which we may gather concerning renal sufficiency that most stress should be laid.

The various tests for kidney function, urea estimation, cryoscopy, the elimination of phloridzin, indigo-carmine, phenolsulphonephthalein, etc., which have succeeded one another in kaleidoscopic fashion are not in my opinion of as much practical value as their scientific masquerade would appear to imply.

This is my opinion based upon a considerable experience with these tests. It would be very desirable if a method could be devised by which the functional and reserve powers of the kidneys could be estimated, but it is too often the case that these powers do not run parallel with the power of excreting any known substance under ordinary conditions. On the other hand, the daily amount and specific gravity of the urine give us a delicate index of the renal condition.

The condition of the bladder itself is of great importance. Over-distention of the bladder should be relieved before any operation upon the prostate is attempted. Some surgeons have practised prostatectomy at the same time with suprapubic cystostomy for the relief of the vesical retention, and while successes have been reported I regard this procedure as highly dangerous. The nervous and cardiovascular mechanisms in the case of these old men are peculiarly susceptible to derangement and every necessary procedure should be tempered with all possible gentleness and freedom from shock-producing factors. In fact, it is advisable not to relieve an over-distended bladder at once by the catheter, but the residual should be reduced gradually from day to day until the bladder is finally allowed to remain empty.

It is not wise to operate in the presence of acute cystitis, but by an indwelling catheter, or, if necessary, suprapubic cystotomy, acute cystitis may be brought into a quiescent condition. A two stage operation, while not ordinarily advisable, may succeed in the case of enfeebled patients with severely infected urinary tracts. The preliminary cystotomy improves the infection and the general condition to a point when prostatectomy can be done. There is some reason to believe that

chronic cystitis is rather favorable than otherwise, inasmuch as a certain bodily resistance to infection has been generated, the local lymphatics are coffer-dammed and the consequences of post-operative infection are less serious than when operation is done in the presence of an uninfected bladder.

In the preparation of the kidneys the use of water, which is the best diuretic, is paramount. It may be given simply by mouth, or if not tolerated in sufficient quantities in this way, the use of saline by rectum or hypodermatically is sometimes efficient in greatly increasing the excretion of the kidneys. Not until satisfied as to the functional powers of the kidneys, let me repeat, should operation be done.

When the heart, kidneys and bowels are acting properly and the patient evidently in good condition operation may be attempted in the full belief that the immediate outcome will not be affected by the type of operation, provided that it be done with equal skill.

The details of the operation of suprapubic prostatectomy need not be given here. There are several factors upon which, individually, I lay stress.

The bladder is exposed by a clean incision with the knife. There is no scraping away or blunt dissection of the prevesical fat. This minimizes the danger of infection of the prevesical tissues.

The interior of the bladder and the projecting prostate may be directly inspected by the simple process of placing two lateral retractors and one in the fundus of the bladder, the mucosa of which is held by a small piece of gauze. A circular incision is made through the mucosa about the vesical orifice of the urethra. This may be done with the knife scissors or preferably the sharpened finger nail. The purpose of the complete circular incision is to avoid the complication of which I have spoken, namely, the formation of a ragged flap of vesical mucosa which may obstruct the outlet.

While the hemorrhage is rarely annoying it is at times sufficiently free to become dangerous. In the suprapubic operation

it may easily be controlled by placing a suture around the bladder margin of the prostatic bed much in the manner of a purse-string, when a small pack of gauze is placed in this bed and the suture tightened the control of hemorrhage from this source is absolute. Hemorrhage in perineal prostatectomy is not so surely controlled.

After-treatment ranks in importance with the preliminary preparation. I do not use continuous irrigation of the bladder. With a large suprapubic opening the bladder cannot fill with clots and a small amount of clotted blood if it forms makes no difference and readily comes away, while long continued irrigation is in some cases a trial to the patient and accomplishes no good. In the perineal operation I concede its necessity.

Careful nursing is essential. I always employ female nurses, as I feel that they understand better the kindly ministrations which mean so much to the comfort and morale of the patient.

The supply of water and consequent free action of the kidneys are the most important post-operative considerations. Hypodermoclysis is given during recovery from ether, and rectal saline is begun as soon as the patient is quiet. Any sign of diminution of diuresis is met by repeated hypodermoclysis. Spartein and caffeine hypodermatically are often given and seem to give good service. Digitalis and nitroglycerine may be given in cardiovascular weakness. Morphia is shunned, and sedatives in general are given sparingly and only upon the strongest indications.

In three or four days, or as soon as the strength will warrant, he is lifted out of bed into a chair and kept sitting until slight fatigue overtakes him. This should not be overdone, nor should it be omitted as it possesses great stimulating action.

In conclusion, I would summarize the advantages of the suprapubic over the perineal operations as:

1. The approach to the prostate is simple and practically bloodless.

2. The enucleation of adenomatous growths is accomplished with ease.

3. The working field is large and under perfect control.

4. The prostate is accessible and can be made more so by digital pressure on its rectal surface and without the danger of injury to the bladder from the use of tractors necessary in the perineal operation.

5. The muscular control of the bladder is not disturbed, since the internal sphincter may be avoided and the compressor urethræ lies outside the line of cleavage. Incontinence is therefore less frequent following this technic.

6. Permanent fistulæ are less frequent after the suprapubic operation. They never occur in fact if the urethra is bougied.

7. Stones can be more easily removed.

8. Sexual potency is maintained as frequently after the suprapubic operation as after the perineal, and the question of sterility is rarely of any consequence.

9. The mortality is, in properly selected cases, no greater and the percentage of uncomplicated cures is larger.

PROSTATECTOMY IN A GENERAL SURGICAL PRACTICE.

A CLINICAL REPORT.*

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In this paper is presented the experience of a general surgeon in what has come to be regarded as a special field. It contains a review of most of my work upon the prostate. Probably not more than twelve cases in all are missing and I have reported every one which I could find.

I gratefully acknowledge the kind assistance of my former House Surgeon, Dr. O. Baumann, in preparing most of these histories, and I am indebted to Dr. F. S. Mandlebaum, Pathologist to Mt. Sinai Hospital, for the histological work.

The surgical records at Mt. Sinai Hospital from July 1, 1897, to July 1, 1898, are missing and may have contained six or seven cases. Of late years, in addition to the hospital records, I have been keeping a private file of all the patients upon whom I operate.

There are pretty satisfactory records of eighty patients, a number considerably less than I thought it would be at the beginning of this investigation. In the accompanying review every case has been reported as faithfully as possible without omission and without explaining why certain ones might have been omitted. To me this work has been most instructive and it is hoped that the thoroughly open and frank exposition of my records may help others.

In addition to the general review there are the histories of thirteen patients which I take to be of more than ordinary interest, some of them illustrating special points.

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* Read before the New York Surgical Society, January 28, 1914.

General Character of the Cases.—The average age of my patients was something over sixty-four years. The youngest was thirty-six, and the oldest eighty-six. Most of them were badly nourished, feeble old men with hardened arteries and diseased kidneys. A number were the victims of chronic bronchitis. Many, especially among the first operated upon, not being acquainted with the possibilities of prostatic surgery, had waited until the catheter could no longer be passed and urinary sepsis had set in. Fully 90 per cent. of these patients were poor subjects even for minor surgery and perhaps one or two of those who died did not have their days shortened by operation. In fact, one of my patients was considerate enough to succumb from the effects of a cerebral hemorrhage which occurred on the day set for operation, but before the anæsthetic had been administered; another instance which shows that we must not expect too much of statistics.

Two were diabetic. One of these died after a cystotomy; one made an uneventful recovery after a two-stage prostatectomy.

No patient who applied for relief was refused the opportunity which surgery might hold out.

Operative Procedure and Preparation.—I was early convinced through the work of Eugene Fuller that the suprapubic approach was the wisest, all things considered, and I have consistently employed this method, being content to note as a mere observer the results achieved in other ways by my colleagues. I do not doubt that in certain cases perineal prostatectomy may be easier to perform than suprapubic. But my contention is that suprapubic *cystotomy* should be the first step, even though it then appears best to proceed with enucleation from below.

Without going into a discussion of details as to the advantages of the high operation, its simplicity, its freedom from untoward sequelæ, the preservation of sexual potency, the easy sight exploration of the bladder, this alone often changing the entire character of the operation, the absence of danger to the rectum—without, then, discussing these and a

number of other points I may say that according to my observation the choice of methods depends on individual experience. The man who has been trained from the beginning as a genito-urinary specialist will be more apt to choose the perineal route while the one who has become familiar with the broader field of general surgery will probably select the suprapubic. To be sure there are always exceptions.

As an illustration of one of the advantages of the high operation, namely, that of clear and direct vision, I present the following unusual case:

CASE No. 73. *Hypertrophy of Prostate, Carcinoma of Bladder, Two-Stage Prostatectomy, and Extirpation of Carcinoma.*—J. M., eighty-six years old, had suffered for several weeks from repeated and severe hemorrhages from the bladder.

X-ray examination showed no calculus. The condition of the kidneys as well as could be judged with the large admixture of blood was sufficiently good considering the man's years. The amount of urine was ample.

For a number of years there had been frequency of urination but little pain.

The patient entered the Private Pavilion of Mt. Sinai Hospital where an attempt at cystoscopy was made, but the instrument could not be inserted. Catheter showed four ounces of residual urine.

On December 30, 1912, I performed a suprapubic cystotomy in local anæsthesia, exposing an enormous, smooth, lobulated prostate. The patient having reacted well, the second stage was undertaken in general anæsthesia on January 6, 1913, one week after the first. Enucleation was not difficult, but after the prostate had been removed I found a papilloma of considerable size in the right part of the trigonum, the tumor having been invisible until the concealing prostate lobe had been removed. The neoplasm was cut away with its base and was sent together with the prostate for histological examination.

In spite of this man's great age his arteries were in excellent condition and with the exception of some bronchitis he might well have passed as a much younger man.

He was in the hospital for 59 days and was discharged well.

I was told that later he developed epididymitis from which he promptly recovered.

The report of Dr. Mandlebaum on the prostate was, "Marked cystic dilatation of glandular elements; otherwise a simple fibrous hypertrophy. Nothing malignant."

The bladder tumor, however, came back with the diagnosis "papillary carcinoma."

This patient has remained well up to the time of this writing more than a year after his operation. The case well illustrates the common fact that a man may be full of years without being "old."

The operation demonstrated that even a cystoscopic examination would not have disclosed the presence of the malignant growth. Had the perineal operation been performed the complete extirpation of the prostatic enlargement would have left a graver disease behind. I can conceive of no method, except the actual removal of the prostate from above, which would have enabled us to relieve and perhaps cure this man.

As a general rule in these cases I do not perform cystoscopy before operation. The procedure has dangers of its own and I know I shall see the bladder clearly at the time of the operation. If there is little residual urine and I suspect other than prostatic disease, cystoscopy is performed. Were a low operation contemplated, however, the cystoscope even with its additional shock and danger to an old man would be absolutely essential.

One post-operative use for the cystoscope I have found. Before permitting the suprapubic opening to close I fill the bladder from above after having washed it as clean as possible and then insert the cystoscope through the fistula, an absolutely painless and non-shocking procedure. It is easy thus to make a careful inspection for bits of slough or loose tissue which should come away lest they form nuclei for subsequent stone. I have three times observed the formation of calculi following prostatectomy, twice in my own practice and once in that of another surgeon. One of my cases, No. 69, is here reported. The record of the other I was unable to find.

CASE No. 69. *Vesical Calculi Following Prostatectomy.*—E. W., aged sixty-four years, was operated upon for hypertrophy of the prostate and for left hydrocele by the two-stage method, on March 31 and April 2, 1913. The first stage was cystotomy and excision of most of the sac of the hydrocele. The second stage, prostatectomy and left orchidectomy for which I had no permission at the time of the first operation. The testis was in a state of fibrosis and was obviously not functionating.

The patient made a good recovery, although I found it extremely difficult to secure acidity of the urine. He was discharged on May 18, 1913.

During the summer the patient suffered greatly with pain on urination and frequent stoppages of the stream. The urine was very foul.

In October, 1913, he returned to me for examination and with the aid of the sound I found a calculus. Confirmed by cystoscopy.

On October 28, I again opened the bladder suprapubically and removed two rather soft calculi each one the size of a small English walnut. To my surprise these stones had not formed around bits of foreign material. They were pure phosphatic calculi.

I found that the urine could be kept acid by the administration of acid sodium phosphate.

The patient went home about ten days after the lithotomy and has remained perfectly well ever since.

In the two other cases each stone had formed around a bit of tissue.

For the sake of completeness I will describe in a few words the method of procedure carried out in the cases of prostatic hypertrophy, although I would not have it understood that there is any hard and fast rule from which what I might call artistic deviation may not become necessary or advisable.

The Preparation.—First: Catheterization every three to six hours according to the condition of the bladder. The more septic the urine the more frequent the catheterization.

Second: The internal administration of strophanthus or some other cardiac stimulant for the twenty-four hours pre-

ceding operation. Urinary antisepsis with salol or some other chemical which does not liberate formaldehyde.

Third: The patient is not put to bed.

Fourth: Repeated examination of the urine, chemical and microscopic.

I have performed none of the supposed tests for renal function because I do not consider that any of them have been shown to be essential in surgery and because I assume that the kidneys are most probably in a more or less diseased condition and that cystotomy is fully indicated even though we know there is poor renal function. The quantity of the urine, however, is noted.

Fifth: The day before operation the bowels are moved with castor oil.

Sixth: I prefer to perform these operations before noon rather than in the late afternoon so that the immediate post-operative observation shall not be at night.

Seventh: One hour before operation the patient receives a hypodermatic injection of morphine, the dose regulated according to his weight and general condition.

The Operation.—Local anæsthesia. Assistant at the patient's head to talk to him and reassure him and to watch the pulse and other vital phenomena.

Bladder usually emptied by catheter but if catheterization is extremely difficult I have frequently permitted the viscus to fill to its capacity and have operated with urine distention.

Incision through skin and aponeurosis and then separation of muscle fibres to the space of Retzius. If the catheter has been put in, the bladder may now be distended with air by means of a rubber bulb while the operator's finger feels the tenseness and general condition of the bladder wall.

The peritoneum is now pushed up out of the way and held with a blunt retractor, other similar retractors holding the wound apart laterally. Rarely is it necessary to tie or clamp a vessel up to this point.

The patient should be informed that air is to be injected so that he may be prepared for the sensation.

Two traction-sutures are passed through the entire thickness of the bladder wall in its upper presenting part and while these draw the viscus toward the surface the wall is incised by knife-puncture. The opening in the bladder high up facilitates the subsequent closure of the fistula as suggested by Squier. The puncture wound made by the knife is now dilated with dressing forceps and the bladder explored, first by touch, then by sight with the aid of retractors, the patient being placed in a modified Trendelenburg's posture. The holding-sutures on each side of the wound in the bladder are now made fast to the aponeurosis so as to prevent the viscus from falling away from the anterior abdominal wall, exposing too freely the space of Retzius. A large tube is put into the bladder and the external wound is packed with gauze.

The patient is put to bed for the day but as a rule he is made to sit up out of bed the following day if only for a short time. The nurse is instructed to see that frequent deep inspirations are taken. In two or three days he is encouraged to walk, the abdomen being confined by a snug binder. Not until the patient is better than before the operation, both subjectively and objectively, is the second stage undertaken. This period in my list of two-stage cases averaged between eight and nine days.

Second Stage.—Operating table slightly elevated below. Patient prepared for general anæsthesia. Nitrous oxide, nitrous oxide and oxygen, ether, chloroform or one of their combinations or sequences is now given to the point of relaxation.

Digital divulsion of the wound.

No instrument in the urethra.

Bladder thoroughly washed out from above.

The gloved finger of an assistant in the rectum to push up the prostate.

Closed, sharp pointed scissors plunged into the prostatic substance at the internal urethral opening or, if the ungloved hand of the operator is being employed, this opening into the prostate may be made with the fingers.

The prostate enucleated in one or more pieces according to the planes of cleavage.

The prostate is often much smaller and far less vascular eight or nine days after the cystotomy than it was at the first operation and bleeding is therefore minimized.

The prostate having been removed the bladder is flushed with water at about one hundred and ten degrees Fahrenheit, then emptied and drained by tube as after the first operation. If hemorrhage has been profuse I place a packing of gauze upon the mucosa which has now fallen into the hollow from which the gland was removed.

Patient sent back to bed with sand bag upon the abdomen for from twelve to twenty-four hours.

In forty-eight hours the gauze packing is removed and the man is urged to leave the bed and pass part of the day in a chair.

The bladder should be irrigated once a day at least through the tube.

The testicles must be supported.

Whether it is possible to avoid epididymitis by vasectomy I am unable to say. I have practised this method in one of the cases here reported (No. 79, December 30, 1910). Benedetto Cinino (*Zentralblatt fur Chirurgie,* 1931, No. 42, page 1644) is quoted as having adopted this method at the time of the primary cystotomy.

I have occasionally noted that after the first week following the prostatectomy an occasional rise of temperature has been explained when rectal examination disclosed retention in the prostatic pocket. This may be emptied by massage once or twice a day and in none of my cases has it caused more than mere annoyance to the operator.

But this is not the place for complete discussion of the subject of convalescence. A detailed work on the management of these cases might well make a volume of considerable size.

A word concerning air inflation of the bladder: Lastaria is quoted in the *Zentralblatt fur Chirurgie* (1913, No. 42, page 1645) as favoring cystotomy with the bladder absolutely

empty. There is no objection to this except that it is slightly more difficult, and in local anæsthesia the speed of the operation is of importance. I have repeatedly opened the bladder on a steel sound of large size put in through the urethra and made to present above the pubes after the incision down to the space of Retzius had been made. Lastaria reports a mishap which is supposed to have occurred to another surgeon, Marion, who lost a patient from air embolism after nine hundred cubic centimetres of air had been used to distend the bladder. It was said that at the post-mortem examination the heart was opened under water and that five hundred cubic centimetres of air escaped! It appears remarkable that in the short period of air distention more than half of the air should have entered a vein and reached the heart. It seems also remarkable that the right heart should have been able to hold a pint of air which after death would not escape into the vessels. The report is most unconvincing. I recollect a number of years ago, two German observers reported an experiment in which air had been injected into a dog's bladder. This air was said to have passed up through the ureter, to have reached the kidney pelvis, to have passed in some way through the kidney parenchyma into the renal veins and then to the heart, causing death! I recollect also that not long afterward some other observer failed to verify these observations in a repetition of the experiment.

Certainly, in the conscious human being moderate insufflation of the bladder is usually accompanied by the escape of much of the air alongside the catheter and it is necessary to continue blowing in order to gain sufficient distention for our purpose. Also, it will be noted that no air is pumped in until the finger of the operator is upon the bladder in the space of Retzius. The penis is never ligated to prevent the escape of any excess of air.

A Review of the Tables.—There were forty patients upon whom operations upon the prostate were performed in one stage for non-malignant disease. The age of one of these patients is not given but the others average 64.74 years. Nine

out of the forty died, or 22.5 per cent. The first two cases in this list were not, properly speaking, prostatectomies at all. In one a part of the gland was removed with the écraseur, in the other the Paquelin cautery was used. Both died. This would leave 38 prostatectomies proper, with 7 deaths or 18.42 per cent.

The thirty-one patients who were discharged from the hospital spent an average of 35.48 days from the time of the operation to discharge.

There were thirty-three cases exclusive of carcinoma in which prostatic enucleation in two stages was performed. Their ages averaged about the same as the single-stage ones, 64.33 years.

Of these two died or 6.06 per cent. The thirty-one others spent an average of 41.62 days in the hospital—about six weeks. This is 6.14 days more than the average of the single-stage cases. But the average number of days between the first and second stages of the thirty-one discharged patients was 8.7, therefore, two and a half days of this time was, as it were, made up. While this is not a particularly important matter it certainly appears to show that the added operation has no tendency in itself to prolong convalescence.

Among the eighty patients there were seven cases of carcinoma of the prostate or 8.75 per cent. Since, among my earlier patients, only the suspected specimens were examined there might have been cases of carcinoma which were not diagnosed. Of these seven acknowledged cases, however, the average age being about 66 years, two were operated upon by the single-stage method and both died. Five by the two-stage method and four recovered. Two patients showed metastases in the upper part of the femur. The pre-operative histories of these cases of carcinoma were about the same as those of hypertrophy. On examination the stony hardness of the rectal mass would arouse suspicion and at operation the induration of the tumor and the absence of the customary cleavage planes have more than once called my attention to the malignant character of the disease.

All the cases reported here were of the intracapsular non-ulcerating variety. None showed subsequent carcinoma of the suprapubic scar, although I have seen this unfortunate sequel in a case of squamous celled carcinoma of the bladder without prostatic involvement, and it is a well-known phenomenon for papillomata of the bladder to be thus transplanted. It appears to me that the adenocarcinoma which comes as a degenerative focus in a case of adenomatous hypertrophy is not a very malignant form of cancer. Cases 76 and 79 indicate this.

Vesical calculi were found in thirteen cases or 16.25 per cent. It is my observation that in multiple bladder stones or single calculus of great size the postprostatic pouch is apparently deepened by the weight. Simple lithotomy may then be followed by a vesical fistula which will not close without prostatectomy.

In Case No. 44 I performed suprapubic lithotomy, removing twelve large stones which aggregated 120 grammes in weight. The prostate was but slightly enlarged and its elimination was not contemplated. Thirty-two days after the lithotomy, however, although the patient was urinating through the natural passages most of the urine came by way of the fistula. Therefore, I operated again, enucleating the small adenomatous prostate. Recovery was prompt and complete, the patient remaining well until the present time.

Post-operative Complications.—The most frequent condition was epididymitis which occurred seven times. Once the testicle became acutely septic and had to be removed. The other six were what might be called surgical aggravations.

Case No. 26. *Adenoma of Prostate; no Residual Urine; Suprapubic Prostatectomy.*—S. T., aged forty-seven years, complained of increasing frequency of urination. He had consulted a number of surgeons but because he completely emptied his bladder and because the prostate was very small by rectum operation had not been suggested. There was no bleeding, no loss of weight.

On cystoscopy I found a mass, smooth in outline, just to the left of the median line of the prostate on the posterior wall.

On May 10, 1905, I operated, placing the patient in Trendelenburg's posture and exposing clearly to the eye the little tumor. I removed it easily by enucleation. Nineteen days afterward a left suppurative epididymo-orchitis set in, so severe in character that on June 3, only four days after the onset, I performed orchidectomy. He then made a prompt and permanent recovery. All his symptoms were relieved.

Examination of the tumor showed it to be an adenoma.

The testis was honeycombed with abscesses.

This case is of further interest because the patient was able to empty his bladder completely before operation.

The next complication was that of hemorrhage of which there were five cases.

One a slow continued hemorrhage which was finally checked by cauterization.

Case No. 52. *Continuous Hemorrhage Following Prostatectomy in Two Stages; Cauterization of Bleeding Point.*—The patient, W. E. S., fifty-eight years old, was operated upon by the two-stage method, the prostatectomy having been performed on November 29, 1907. After the second operation the bleeding never entirely ceased and although Mr. S. was up and about with good appetite he became progressively more anæmic until about two weeks after the operation I was forced to intervene.

In general anæsthesia I dilated the suprapubic wound with the patient in Trendelenburg's posture and easily exposed a minute bleeding vein in the mucosa, there being no hemorrhage from the intravesical prostatic wound itself. The bleeding point was touched with the actual cautery and the patient made a rapid and complete recovery.

Pneumonia occurred three times and one of the patients died.

Three patients had uræmia and all died.

Three patients died after cystotomy without an operation upon the prostate. On careful consideration I have counted these with the one-stage cases. While they were not actually

cases of prostatectomy the complete operation was certainly contemplated, and I think there can be but little doubt that had these patients been subjected to the major procedure at the original operation they would have died just as they did after the minor one.

Among the more unusual forms of prostatic obstruction I report here a case of aberrant prostate. This patient was since my own boyhood my intimate friend and I can corroborate, from personal observation, the interesting facts of the early history.

CASE No. 33. *Aberrant Prostate; Suprapubic Extirpation.*—F. W. L., forty-six years old, had always noted that it took him a very long time to empty his bladder and that the stream was not as forcible as he considered normal. Actual dysuria began about his forty-fourth year when there was occasional retention with the necessity for catheterization. After one of these attacks there was severe cystitis with urinary sepsis.

On March 15, 1907, I performed suprapubic cystotomy. I found an enormous bladder not greatly trabeculated, a large but apparently not diseased prostate, and to the left side and near the floor of the urethra there was a mass the size of a buck-shot, which I removed, cauterizing the base.

Thirty-five days later he left the hospital entirely well and has remained so up to the present time.

Dr. Mandlebaum reported on the histology with the diagnosis of "aberrant prostate." I think there is little doubt that the childhood symptoms of this patient may be ascribed to this peculiar anomaly.

It is to be regretted that pathological examinations were seldom made in my earlier cases.

Besides the review, which speaks for itself, there is little more to say. With the exception of the case of leukæmia here reported (Case 71) and those of carcinoma I am well satisfied with the apparently perfect restoration of function of all the patients who made operative recoveries. My early mortality statistics in the one-stage operation are not brilliant, but again I call attention to the fact that every patient who

came for treatment, no matter how bad the condition, was operated upon. This is not a series of selected cases.

With the two-stage work and its 6 per cent. of mortality I can find little fault. The two patients who died could probably not have been saved by any other method while some whose cases looked most desperate made good recoveries. (For example, case of M. H., No. 60, here reported.)

It is quite probable that increasing skill and experience in the care of these patients both before and after operation may be elements which have a bearing on the improvement of statistics after the adoption of the two-stage operation. Still, the change was of too sudden a nature to be thus accounted for. Also, the loss of a one-stage patient, Case No. 35, after the general adoption of the two-stage principle, and the death of three patients after simple cystotomy form arguments against this theory.

Statistics must be taken for what they are worth. Had I written this paper one year ago there would have been no death rate from the two-stage suprapubic prostatectomy.

CASE No. 8. *Post-operative Hypogastric Hernia.*—J. R. This patient, sixty-one years old, was admitted to Mt. Sinai Hospital on May 16, 1901, with a suprapubic sinus of small size from a previous cystostomy. This was in the early days of radical prostatic surgery and at the time of his first operation the surgeon who operated was not prepared to perform prostatectomy.

The patient had much pus and blood in his urine and there was a massive suprapubic cicatrix with a pelvic exudate pericystic in character.

On May 25, in nitrous oxide and ether anæsthesia I excised the sinus and removed a large fibromatous prostatic mass. The wound was healed and the patient discharged on August 17, fifty-one days after the operation. The pelvic exudate had not yet, however, absorbed.

I followed this case for a number of years and it is the only one in which I ever saw a suprapubic hernia develop. This hernia had no neck but was a general bulging of the entire hypogastric abdominal wall. It was easily retained by a binder.

CASE No. 15. *Spinal Syphilis; Previous Bottini's Operation;*

Single-Stage Suprapubic Prostatectomy.—Nathan M., aged sixty-four years, was admitted to Mt. Sinai Hospital on July 14, 1902. He was suffering from advanced spinal syphilis of the tabetic type. For some years he had had bladder symptoms with retention and overflow, the so-called residual urine amounting to about 16 ounces. More than a year before his admission to Mt. Sinai he had been operated upon by the Bottini cauterization method but without relief and an authoritative neurological opinion was that the vesical retention was caused by his spinal lesion.

Cystoscopic diagnosis was not so accurate in those days as it is now, but by the more usual general examination I concluded that a suprapubic exploration was justified.

Accordingly, on July 15, 1902, I opened the bladder under gas and ether anæsthesia followed by chloroform. It was at once evident that a considerable hypertrophy of the prostate existed and that a pedunculate middle lobe had been divided sagittally by the Bottini's cautery. The two parts had not fused in healing but fell together in such a manner that they effectually blocked the urethra. Prostatectomy in the usual manner was performed and 34 days later the patient left the hospital well.

He remained in perfect health so far as his urinary apparatus was concerned and died only a year ago.

Case No. 35. *Prostatic Hypertrophy With Retention and Overflow; Myocarditis; One-Stage Suprapubic Prostatectomy: Death.*—N. N., aged seventy-one years, after two years of bladder symptoms had an attack of retention and overflow which continued for about a week before a catheter was passed.

I strongly advised cystotomy then prostatectomy but the patient and his friends were most urgent in their desire for a one-stage operation and most unfortunately I acceded.

On April 22, 1907, I operated opening the bladder suprapubically under local anæsthesia then continuing with ether. There was little bleeding and no cause for shock but the patient went to pieces and died a cardiac death in about twenty-four hours.

Post-mortem examination showed grave disease of the coronary arteries. The prostate was the seat of adenomatous hypertrophy.

Case No. 39. *Vesical Calculi; Enlarged Prostate; Deaf Mutism; One Stage Prostatectomy.*—J. S., aged forty-two years, was admitted to Mt. Sinai Hospital on April 2, 1912. The patient

was a deaf mute and was unable to read or write and indicated by signs that he had pain in the urethra on urination.

The X-ray showed vesical calculi. The general health of the man was good and on April 8, 1912, I performed a suprapubic cystotomy in general anæsthesia. Four calculi were removed and on exposing the bladder the mucosa was found tensely injected. There was a deep retroprostatic pouch and the prostate itself, though distinctly enlarged and of such form as to cause a barrier to urination, was probably not the sole cause of the distressing symptoms. Enucleation in three pieces. The bladder was much hypertrophied and of a rather abnormal shape, being considerably elongated but not widened. It had evidently been in a state of chronic spasm so that it held practically no fluid when the patient was not anæsthetized.

The reason for breaking my rule and performing this prostatectomy at one sitting was because of the difficulty in making the patient understand. His condition also was so good that the added risk did not appear to be great.

The histology of the specimen which was removed was "adenoma, hypertrophy of the ducts, perifollicular inflammation."

A number of days after the suprapubic wound had healed it broke down again following an attack of retention probably due to the presence of a loose slough which interfered with urination. The wound closed and thirty-four days after operation the patient was discharged from the hospital urinating normally.

CASE No. 36. *Adenomatous Hypertrophy of the Prostate With Acute Inflammation; Prostatectomy.*—J. L., thirty-six years of age, was operated upon on December 25, 1907. There had been repeated attacks of urethritis and distinct prostatism.

The past history of the patient was one of sexual excess. For more than a year there had been dysuria with incomplete emptying of the bladder. By rectum there was a large, soft, rather tender prostate.

At the operation characteristic hypertrophy of the prostate was found and the mass enucleated. It was 30 grammes in weight and honeycombed with purulent foci.

Histology reported by Dr. Mandlebaum as "adenomatous hypertrophy with acute inflammation."

In four weeks he was well and he has remained well. Virility and urination normal.

CASE No. 40. *Suprapubic Cystotomy; Death.*—This case is one of a man seventy-three years of age, M. R., who was admitted to Mt. Sinai Hospital on January 12, 1913. He had retention with overflow. The urine contained a large amount of albumin, red blood cells and many white cells.

On January 13, 1913, under local anæsthesia I opened his bladder for drainage, intending to perform prostatectomy at another time. His condition after the operation was good, but in twenty-four hours he became noisy, delirious and uræmic, with fatal issue.

CASE No. 60. *Enormous Vesical Calculus; Hypertrophy of Prostate; Myocarditis; Glaucoma; Two-State Prostatectomy.*—This patient, M. H., had had 15 years of dysuria. He had been examined by many physicians and surgeons. When I saw him in October, 1910, there was constant vesical tenesmus and after urination only a few drops of what was thought to be "residual" was obtained by catheter. I immediately advised radiography which the man put off for two months longer. He then entered Mt. Sinai Hospital in a dreadful condition with urinary sepsis, a miserably acting heart and almost blind on account of his glaucoma.

Radiography showed a shadow of great size far above the pubic region. Cystoscopy caused severe hemorrhage so I had to desist, but the searcher immediately felt the stone. I at once opened the bladder and removed a calculus which when perfectly dry weighed 3 ounces. The bladder wall hugged the calculus closely, the high position of the stone being explained when I discovered a prostate so large that the stone, as it were, on top of it was far above the pubes.

A week after the lithotomy, in chloroform anæsthesia by Doctor Bennett, I enucleated a prostate the size of a large lemon. Recovery was perfect with the customary great improvement in general health.

This man I considered to have been what I might call the worst surgical risk of my entire experience.

CASE No. 71. *Suprapubic Prostatectomy in a Leukæmic Patient.*—The following history is of interest principally because of the unusual complication of leukæmia. In this fatal disease

one would naturally make every effort to avoid a capital surgical operation on account of the well-known hemorrhagic tendency.

In this case, however, the vesical condition had become so threatening that something had to be done. Fortunately there was an operative recovery.

G. S., aged seventy-two, had suffered for some years with the usual symptoms of prostatic obstruction and had been catheterizing himself with a woven instrument for one year.

In August, 1913, he had been operated upon for a left strangulated inguinal hernia and for the three following weeks he had evidently suffered from vesical distention with overflow, no catheter having been passed during that time.

At his own suggestion his physician catheterized him and withdrew then a large quantity of urine containing much foul pus.

On September 20, 1913, he came to New York where he entered Miss Maluk's private hospital.

I found a feeble, pale, emaciated man. The temperature, however, was normal and the pulse 80, showing some hypertension. Twenty-three ounces of extremely foul urine were withdrawn by catheter the last part of which was almost pure pus. Frequent catheterization and irrigation improved him and on September 24, 1913, I performed suprapubic cystotomy preliminary to a contemplated prostatectomy. At this time there were fifteen ounces of residual urine. By rectum there was a large soft prostate. The spleen was very large and hard, extending beyond the median line and far below the umbilicus. The patient stated that he had had malaria and that a physician had told him twelve years before that he had an enlarged spleen. The lymph-nodes in the various parts of the body were not enlarged and at this time no blood examination was made.

A week later, in gas and ether anæsthesia, a prostate three ounces in weight was enucleated. The lobe on the anterior wall was very large and fleshy.

Thirty-seven days after the first operation he was discharged urinating normally and apparently in excellent general condition. Within the next few weeks he gained 16 pounds in weight and I dismissed the case from my mind. Then, however, he began to have pain in the region of the old hernia wound and an induration with slight reddening of the skin appeared there. Although the temperature remained normal I thought that probably a deep,

mild infection existed. Gradually the left leg and thigh became flexed so that walking was impossible on account of the pain in the groin. No spontaneous pain. Appetite good. Pulse good. The spleen appeared to be somewhat larger than it was while at the hospital, now filling the entire left upper quadrant.

Thinking that a viscus had become adherent at the site of the old hernia operation I sent the patient to Mt. Sinai Hospital where on November 28, 1913, in ether anæsthesia, a small incision was made through the lower part of the left rectus muscle and the finger then detected a large mass of apparently retroperitoneal lymph-glands. No hernia or adhesion was present. The blood, meantime, had been examined and showed the characteristic picture of a lymphatic leukæmia.

Although this patient had been able to empty his bladder perfectly the urine became foul during the three days following the operation and the suprapubic wound reopened. It closed again within 36 hours and a week after the operation he was discharged.

Case No. 72. *Prostatic Hypertrophy; Operation in Two Stages; Death.*—J. G. P., aged seventy-five years, was operated upon on October 28, 1913, the bladder being opened under local anæsthesia.

For several years there had been symptoms of prostatic disease with cystitis, and catheterization had been necessary. The patient had albumin and casts, indicating a type of nephritis which might be expected in a man of his years. The kidneys were, however, functioning in a comparatively normal manner.

After the cystotomy, although there was plenty of urine, the patient developed hiccough and this continued without intermission for fourteen days. At the end of two more weeks, however, or 27 days following the first operation, his condition was better than it had been before the first stage and under nitrous oxide gas and oxygen the prostate was easily enucleated. The patient had a chronic bronchitis and after the second stage there was considerable cough and again for three or four days, hiccough. Everything then, however, appeared to be going on very smoothly and we hoped for a speedy recovery when, without warning, the heart gave out and eight days after his second operation there was general œdema terminating in pulmonary œdema and death.

In this case, in order to be on the safe side, I waited 27 days

No.	Name.	Age.	Date of Operation.	Preoperative Complications.	Anæsthetic.	Character of Operation.	
1	H. M.	63	Nov. 13, 1896	Vesical calculi; hemorrhagic cystitis	Chloroform and ether	Removal (?) of prostate with ecraseur; perineal drain	Hemorrha
2	K. R.	56	June 27, 1900	Chronic sepsis; emphysema	N_2O and ether	Actual cautery of prostate; perineal drain.	Gradual d
3	I. L.	74	Sept. 25, 1900	Previous castration; catheter life 22 years; urinary sepsis	Chloroform	Prostatectomy; perineal drain	Uneventfu
4	M. G.	58	May 28, 1901	Retention	N_2O and ether	Removal of pedunculate middle lobe	Uneventfu
5	J. R.	58	July 4, 1901	Attacks of retention	N_2O and ether	Prostatectomy by enucleation	Uneventfu
6	J. H. C.	56	June 25, 1901	Laceration of urethra; false passage; hemorrhage	Chloroform	Perineal section then suprapubic enucleation	Pneumoni
7	S. L.	63	May 11, 1901	Bronchitis; myocarditis; much pus in urine	Eucaine 6 per cent.	Cystotomy; no prostate operation	Shock
8	J. R.	61	May 25, 1901	Suprapubic vesical fistula from previous operation	N_2O and ether	Excision of fistula; enucleation of prostate	Pelvic exu
9	A. T.	75	Feb. 7, 1902	Nephritis; poor condition; vesical stone	Chloroform	Enucleation	Uneventfu
10	B. W.	65	Feb. 12, 1902	Nephritis; retention	Chloroform and ether	Enucleation	Polyuria (
11	S. G.	53	Feb. 8, 1902	Retention	N_2O and ether	Enucleation	Uneventfu
12	A. L.	80	May 13, 1902	Retention	N_2O and ether	Enucleation and perineal drainage	Perineal v
13	H. K.	71	June 20, 1902	Catheter life	Chloroform	Enucleation	Uneventfu
14	J. L.	64	June 28, 1902	.....	N_2O and ether	Enucleation	Left orchi
15	N. M.	64	July 15, 1902	Spinal syphilis; residual urine 16 oz.	N_2O and ether and chloroform	Enucleation	Uneventfu
16	R. L.	75	Nov. 24, 1902	Diabetes; vesical calculi and hematuria; 10 years	Chloroform	Cystotomy only	Coma
17	J. S.	77	Jan. 4, 1903	Vesical calculi; nephritis; bad condition; œdema of feet and legs	N_2O and ether	Enucleation after removing three calculi	Uneventfu
18	R. G.	70	Nov. 24, 1903	.....	N_2O and ether	Enucleation	Uneventfu
19	H. J.	?	Dec. 26, 1903	.....	N_2O and ether	Enucleation	Uneventfu
20	L. M.	68	Jan. 23, 1904	Retention and overflow	N_2O and ether	Enucleation	Uneventfu
21	J. L.	49	April 25, 1904	Retention; neurasthenia	N_2O	Enucleation	Uneventfu
22	T. A.	60	May 13, 1904	Cystitis; cicatrix of former transverse suprapubic cystotomy; retention and catheter life	N_2O and ether	Enucleation of large prostatic growth	Slow
23	B. B.	77	Feb. 14, 1905	Nothing remarkable	N_2O and ether	Enucleation	Right orc
24	L. F.	68	May 3, 1905	Nothing unusual	N_2O and ether	Enucleation	Uneventfu
25	S. M.	55	Nov. 18, 1904	Vesical calculi	?	Enucleation; 3 stones removed	Uneventfu
26	S. T.	47	May 10, 1905	Years of dysuria	N_2O and ether	Removal of small middle lobe	Left supr chidect
27	J. B.	69	May 20, 1905	Nothing of note	N_2O and ether	Enucleation	Uneventfu
28	A. P.	70	Nov. 24, 1905	.....	N_2O and ether and chloroform	Enucleation	Good reac
29	S. L.	70	Jan. 9, 1906	.....	Chloroform	Enucleation	Uneventfu
30	S. S.	80	Jan. 24, 1906	Nocturnal frequency for ten years; recent severe hemorrhages after catheter	Chloroform	Enucleation	.....
31	H. H.	52	June 12, 1906	.....	N_2O and ether	Enucleation	Uneventfu
32	M. O.	69	Feb. 26, 1907	120 c.c. residual but great prostatism; some hemorrhage	N_2O and ether	Enucleation	Uneventfu
33	F. W. L.	46	Mar. 15, 1907	Symptoms many years; cystitis following catheter	N_2O, ether and chloroform	Enucleation and cauterization	Uneventfu
34	S. H.	37	Apr. 2, 1907	75 c.c. residual clear urine; nervous irritability	N_2O and ether	Enucleation of small prostatic protuberance	Uneventfu
35	N. N.	71	Apr. 22, 1907	Passed 25 c.c. at a time (overflow); patient in a poor condition; myocarditis?	Local for cystotomy then N_2O and ether	Enucleation	Œdema cardiac
36	J. L.	36	Sept. 25, 1907	Repeated urethritis; sexual excess; distinct prostatism	N_2O and ether	Enucleation	Uneventfu
37	L. H.	59	Jan. 22, 1909	.....	N_2O ether and chloroform	Enucleation	Uneventfu
38	A. L.	44	May 23, 1910	Vesical stone	N_2O and ether	Enucleation and removal of stone	Fever (te
39	J. S.	42	Apr. 8, 1912	Vesical stone	N_2O and ether	Enucleation and removal of large stones (3)	Retentio
40	M. R.	73	Jan. 13, 1913	Retention; nephritis	Local	Cystotomy only	Delirium

ROSTATIC DISEASE EXCLUSIVE OF CARCINOMA.

Course.	Postoperative Days in Hospital.	Pathology.	Result.	Remarks.
Hemorrhage shock	1	.....	Died	Crude technic.
Gradual deterioration	10	.....	Died	
Uneventful	28	.....	Well	Patient well in about four weeks; lived four years with perfect function.
Uneventful	41	Fibrous hypertrophy	Well	Followed up for years.
Uneventful	26	Fibrous hypertrophy	Well	Followed up for years.
Pneumonia epididymitis	32	Large soft prostate (no histological examination)	Well	Followed many years.
Shock	1	.....	Died	Autopsy showed right pus kidney; very large prostate found at operation but not removed.
Pelvic exudate about bladder	79	.....	Well	Hernia in suprapubic region but easily held by pad and bandage; followed for years well.
Uneventful but slow	51	.....	Well	Well for some years.
Polyuria uremia	6	Large soft prostate	Died	Drained over 100 ounces a day but died in coma; no glycosuria.
Uneventful	38	.....	Well	
Perineal wound suppurated	27	.....	Well	Died some months later; suppuration of perineal wound contributory cause.
Uneventful	32	.....	Well	Well ten years later.
Left orchitis; pneumonia	60	.....	Well	
Uneventful	34	Fibromata	Well	Had been operated upon by Bottini's cauterization method without relief; case was said to be one of "spinal" retention; perfect function after prostatectomy.
Coma	4	.....	Died	
Uneventful	42	.....	Well	Remained well several years, dying of cardiorenal insufficiency.
Uneventful	21	.....	Well	
Uneventful	25	.....	Well	
Uneventful	31	Marked glandular hypertrophy	Well	Well for years; unusual increase in sexual power.
Uneventful	35	.....	Well	Several months of impotency, then recovery.
Slow	90	.....	Well	Ten years before he had had suprapubic cystotomy by another surgeon; some of the prostate said to have been burned away at that time; healing after my operation very slow because of former transverse cut; my own line was sagittal.
Right orchitis	27	.....	Well	
Uneventful	25	.....	Well	
Uneventful	27	.....	Well	Followed years well.
Left suppurative orchitis with orchidectomy	34	Adenoma and chronic inflammation	Well	19 days after operation left epididymo-orchitis with suppuration; 4 days later the left testis was removed; rapid recovery.
Uneventful	21	.....	Well	
Good reaction, then "collapse"	2	Fibroadenoma	Died	Collapse twenty-four hours after operation; no remarkable hemorrhage.
Uneventful	60	.....	Well	Followed for years well.
.....	3	Slight inflammation	Died	Note advanced age of patient; probably cardiorenal death.
Uneventful	24	.....	Well	
Uneventful	22	Fibroadenomatous hypertrophy	Well	Is well now (1914).
Uneventful	35	Aberrant prostate with cystic degeneration	Well	Is well now (1914); history in body of paper.
Uneventful	19	.....	Well	Patient has remained well (1914).
Œdema of lungs and suppression; cardiac	1	Adenomatous hypertrophy	Died	Postmortem showed atheroma of coronary arteries. I was persuaded against better judgment to perform this operation in one stage.
Uneventful	14	Adenomatous hypertrophy with acute inflammation	Well	Prostate honeycombed with purulent foci; about 30 grammes in weight.
Uneventful	18	Glandular hypertrophy	Well	
Fever (temp. 103°) first 10 days	26	Adenomatous and glandular proliferation	Well	Followed to date well.
Retention	56	Adenoma; hypertrophy of ducts; perifollicular inflammation	Well	Case in body of paper.
Delirium; uremia	5	.....	Died	Case in body of paper.

No.	No.	Name.	Age	Dates of Operations.		Days between Operations.	Preoperative Complications.	Anæsthetics.		Character of Operations.	
				1st.	2nd.			1st	2nd.	1st.	2nd.
41	1	R. L.	66	Aug. 26, 1896	Sept. 9, 1896	14	Emphysema; great obesity; cystitis; calculi	Chloroform	Eucaine	Cystotomy	Prostatic enucleation
42	2	M. M.	62	Jan. 10, 1905	Jan. 13, 1905	3	Severe hemorrhages and retention of urine	N_2O	N_2O and ether	Cystotomy and Paquelin to bleeding vein	Enucleation
43	3	I. W.	65	Oct. 9, 1906	Oct. 18, 1906	9	Diabetes mel.; myocarditis; cystitis; hemorrhages; catheter life for years	Cocaine and "Schleich"	N_2O and ether	Cystotomy	Enucleation
44	4	S. B.	56	Nov. 25, 1905	Dec. 27, 1905	32	Twelve large vesical stones	N_2O, ether and chloroform	N_2O and ether	Suprapubic lithotomy	Enucleation
45	5	N. R.	52	Sept. 26, 1907	Sept. 30, 1907	4	Retention; cystitis	Local	N_2O and ether	Cystotomy	Enucleation
46	6	K. K.	54	Oct. 26, 1906	Nov. 2, 1906	7	Nothing remarkable	Local	N_2O and ether	Cystotomy	Enucleation
47	7	G. C.	70	June 5, 1907	June 14, 1907	9	Had been operated upon for supposed stricture with retention; catheter for some years	Local	Ether and chloroform	Cystotomy	Enucleation
48	8	H. P.	60	June 28, 1907	July 8, 1907	10	.....	Local	N_2O and ether	Cystotomy	Enucleation
49	9	L. B.	52	May 29, 1908	June 5, 1908	6	Cystitis and bacteriuria; retention	Local	N_2O and ether	Cystotomy	Enucleation
50	10	J.W.	65	Jan. 4, 1908	Jan. 13, 1908	9	....	Local	N_2O and ether	Cystotomy	Enucleation
51	11	J. C.	73	Dec. 24, 1907	Jan. 3, 1908	10	.....	Local	"General"	Cystotomy	Enucleation
52	12	W. E. S.	58	Nov. 20, 1907	Nov. 29, 1907	9	Retention and catheter	Local	N_2O and ether	Cystotomy	Enucleation
53	13	J. L. M.	62	Dec. 26, 1907	Dec. 31, 1907	5	.....	Local	Chloroform and ether	Cystotomy	Enucleation
54	14	M. S.	70	May 13, 1908	May 20, 1908	7	.....	Local	N_2O and ether	Cystotomy	Enucleation
55	15	M. F.	70	Nov. 27, 1909	Dec. 4, 1909	7	Vesical stones, retention and overflow	Local	Chloroform	Lithotomy	Enucleation
56	16	G. P.	74	Nov. 28, 1908	Dec. 9, 1908	11	Extremely high blood pressure; myocarditis; constant dribbling of urine	Local	N_2O and ether	Cystotomy	Enucleation
57	17	J. B.	70	June 26, 1909	July 3, 1909	7	Retention and overflow	Local	N_2O and ether	Cystotomy	Enucleation
58	18	G. K.	55	June 11, 1909	June 16, 1909	5	Retention and overflow	N_2O	N_2O and ether	Cystotomy	Enucleation
59	19	M. S.	63	July 1, 1909	July 8, 1909	7	Urinary sepsis; retention, hiccough, drowsiness	Local	N_2O and ether	Cystotomy	Enucleation
60	20	M. H.	63	Dec. 15, 1910	Dec. 22, 1910	7	Myocarditis; glaucoma; pyelitis; calculus and hemorrhage; cystitis	Local	N_2O and ether	Lithotomy	Enucleation
61	21	A. S.	56	Oct. 25, 1910	Oct. 31, 1910	6	Retention and overflow	Local	N_2O and ether	Cystotomy	Enucleation
62	22	L. K.	44	Sept. 28, 1910	Oct. 8, 1910	10	Neurosis; retention	Local	N_2O and ether	Cystotomy	Enucleation
63	23	D. I.	59	Mar. 25, 1911	Mar. 30, 1911	5	Retention; cystitis	Local	N_2O and ether	Cystotomy	Enucleation
64	24	F. M.	62	Mar. 7, 1910	Mar. 15, 1910	8	Large amount residual urine	Local	N_2O and ether	Cystotomy	Enucleation
65	25	D. C. D.	66	Oct. 11, 1911	Oct. 16, 1911	5	Prostatism; vesical stone; residual urine; cystitis	Local	N_2O and ether	Lithotomy	Enucleation

Operations. 2nd.	Course.	Post-operative Days in Hospital.	Pathology.	Result.	Remarks.
Prostatic enucleation	Slow	71	.....	Improved	The patient a mountain of flesh; anæsthesia badly borne; partial prostatectomy only; discharged with glass bulb-tube in wound; lived some years but no function of urination.
Enucleation	Uneventful	45	.....	Well	Have learned that the patient had a hemorrhage in 1913.
Enucleation	Uneventful	30	Adenomatous hypertrophy with retention-cysts	Well	Remained perfectly well for some years; died of cardiac insufficiency and phlegmon of arm.
Enucleation	Uneventful	77	.....	Well	Prostatectomy not at first contemplated but decided on when suprapubic fistula refused to heal; patient well to-day, 1914.
Enucleation	Two severe hemorrhages; epididymitis	53	Hypertrophy; dilatation of ducts; chronic inflammation	Well	
Enucleation	Uneventful	36	Adenomatous hypertrophy	Well	
Enucleation	Uneventful	29	Hypertrophy and tubular dilatation; no evidence of tuberculosis	Well	Nodular prostate had suggested tuberculosis.
Enucleation	Uneventful	29	.....	Well	
Enucleation	Uneventful	45	Fibrous hypertrophy	Well	Bacteriuria not cured; very obese abdomen made ambulant dressing difficult; patient newly married. Normal power of copulation.
Enucleation	Uneventful	45	Cystic and adenomatous hypertrophy	Well	
Enucleation	Uneventful	25	Hypertrophy and cystadenoma; contained calculi	Well	
Enucleation	Slow hemorrhage	46	Adenomatous hypertrophy	Well	Constant slow hemorrhage for many days; wound dilated and bleeding point cauterized; immediate cessation of bleeding; prompt recovery; followed for years.
Enucleation	Uneventful	25	Adenomatous hypertrophy	Well	
Enucleation	.....	36	.....	Improved	Patient discharged against advice; wound not healed.
Enucleation	Uneventful	37	.....	Well	Patient well 1914.
Enucleation	Right pleurisy hemorrhage in space of Retzius	42	.....	Well	Had been advised against operation because of high blood pressure, etc.; played golf in the following spring.
Enucleation	Uneventful	40	.....	Well	Followed for year or more.
Enucleation	Hemorrhage	41	Adenomatous hypertrophy; cystic dilatation	Well	Hemorrhage from bed of prostate and bladder had to be packed; followed two years; well.
Enucleation	Uneventful	23	.....	Well	3 hourly catheterization 48 hours before first operation; great postoperative increase of sexual power; well to date.
Enucleation	Chills and fever after first urination	42	.....	Well	Enormous calculus, hugged closely by bladder; patient greatly improved in general health by prostatectomy.
Enucleation	Fever and chills unexplained after second operration	29	.....	Well	
Enucleation	Uneventful	42	.....	Well	Prostate greatly shrunken between two stages; small hard lobe in deep urethra.
Enucleation	Temp. 104° 12 days after operation cause unknown	39	Adenomatous hypertrophy with cystic dilatation	Well	Well to date.
Enucleation	Uneventful	32	Fibrous hypertrophy with nodules	Well	Marked increase in sexual power; well to date, January, 1914.
Enucleation	Uneventful	29	.....	Well	Well to date.

No.	No.	Name.	Age	Dates of Operations.		Days between Operations.	Preoperative Complications.	Anæsthetics.		Character of Operati	
				1st.	2nd.			1st.	2nd.	1st.	2nd
66	26	M. V. P.	80	Mar. 5, 1912	Mar. 25, 1912	20	Asthma; chronic bronchitis; enormous inguinal hernia; acute prostatism (?) few days only; 16 oz. residual urine; calculi	Local	Chloroform	Lithotomy	Enuclea
67	27	E. P.	46	Oct. 16, 1912	Oct. 21, 1912	5	.....	Local	N_2O and ether	Cystotomy	Enuclea
68	28	A. J.	73	Jan. 30, 1913	Feb. 6, 1913	7	Acute retention with overflow—48 hours	Local	N_2O and oxygen	Cystotomy	Enuclea
69	29	E. W.	64	Mar. 31, 1913	April 7, 1913	7	Enormous left hydrocele; retention and overflow	N_2O and ether	N_2O	Extirpation of tunica vaginalis and cystotomy	Left orc tomy; cleatic prosta
70	30	S. B.	80	Apr. 18, 1913	Apr. 26, 1913	8	Prostatism for years but no cystitis until a few days before operation; patient corpulent; severe asthma and chronic bronchitis; kidneys in good condition	Local and N_2O and oxygen	N_2O and oxygen	Cystotomy	Enuclea
71	31	G. S.	72	Sept. 24, 1913	Oct. 8, 1913	14	Leukæmia; urinary sepsis	Local	N_2O and ether	Cystotomy	Enuclea
72	32	G. J. P.	75	Oct. 28, 1913	Nov. 24, 1913	27	Retention; cystitis	Local	N_2O and oxygen	Cystotomy	Enuclea
73	33	G. M.	86	Dec. 26, 1912	Jan. 6, 1913	11	Dysuria for years; hæmaturia 4 days before operation	Local	N_2O and oxygen	Cystotomy	Enuclea prosta extirp of car of b wall

No.	No.	Name.	Age	Dates of Operations.		Preoperative Condition and Complications.	Anæsthetics.		Character of Operation.	C
				1st.	2nd.		1st.	2nd.		
74	1	J. S. L.	49	May 15, 1902	.....	Retention; hemorrhages	N_2O and ether	.....	Suprapubic cystotomy and removal of part of growth	Shock;
75	2	W. A. H.	67	Sept. 27, 1904	.....	Complete retention with overflow; stony hard mass by rectum; no cystitis; cachectic condition	N_2O and ether	.....	Suprapubic cystotomy; attempted removal of small infiltrating growth; perforation of rectum; specimen removed	Shock
76	3	S. M.	77	Jan. 29, 1908	Feb. 7, 1908	Retention after years of "prostatic attacks;" hemorrhage into bladder	Local	Ether and chloroform	Cystotomy, then enucleation; tumor very hard; left seminal vesicle was pulled out *entire*	Uneven
77	4	L. S.	72	Oct. 1, 1909	Oct. 11, 1909	Vesical calculi; continuous vesical spasms for days	Local	N_2O and ether	Suprapubic lithotomy. Prostate adherent and removal piecemeal	Uneven
78	5	M. R.	69	Oct. 17, 1910	Oct. 24, 1910	X-ray showed rarefaction of upper part of left femur; retention and catherization for months; stony hard nodular tumor by rectum	Local	N_2O and ether	Cystotomy. Enucleation	Gradua tion
79	6	M. A. S.	68	Dec. 21, 1910	Dec. 30, 1910 (about)	Usual dysuria for 8 years; forced sexual continence; catheter frequently used	Local	N_2O and ether	Cystotomy. Enucleation and vasectomy	Uneven
80	7	H. S.	60	Oct. 9, 1911	Oct. 14, 1911	Dysuria and attacks of retention	Local	N_2O and ether	Cystotomy. Partial enucleation	Uneven

—Two-stage Cases.—*Continued.*

r of Operations. 2nd.	Course.	Post-operative Days in Hospital.	Pathology.	Result.	Remarks.
Enucleation	Very slow convalescence after first stage; much albumin in the nephritic urine	59	Adenomatous hypertrophy	Well	Died some months later of cardiorenal insufficiency.
Enucleation	Epididymitis	56	Adenomatous hypertrophy	Well	Followed for about a year.
Enucleation	Uneventful but ischorectal abscess developed and was incised	43	Adenomatous hypertrophy	Well	Well to date.
Left orchidectomy; enucleation of prostate	Slow healing of scrotal wound; urine alkaline	48	.....	Well	Oct. 28, 1913, after some months of dysuria, cystoscoped and found two calculi; cystotomy through old cicatrix and stones removed; they had *no nuclei* but were soft and phosphatic; patient now well and urine acid.
Enucleation	Postoperative pneumonia	11	.....	Died	
Enucleation	Uneventful	37	.....	Well	Leukæmic glands in groins; gradual deterioration; case reported in body of paper.
Enucleation	Hiccough; epididymitis	35	.....	Died	Case to be reported in body of paper.
Enucleation of prostate and extirpation of carcinoma of bladder wall	Uneventful	59	Fibrous hypertrophy of prostate; papillary carcinoma of bladder	Well	Patient well now more than a year after operation; history in body of paper.

rated Upon by Suprapubic Method.

	Course.	Post-operative Days in Hospital.	Pathology.	Result.	Remarks.
val	Shock; hemorrhage	5	Carcinoma of prostate	Died	Great mass infiltrating bladder, seminal vesicals and surrounding tissues.
ted th; nen	Shock	1	Adenocarcinoma	Died	Patient an extremely bad subject and took anæsthetic badly; no great hemorrhage.
tu- esi-	Uneventful	35	Adenocarcinoma	Operative recovery	Function re-established and patient married more than a year later.
ate eal	Uneventful	35	Adenocarcinoma	Operative recovery	Patient discharged apparently well; was then lost sight of; had been operated upon for stone ten years before by suprapubic method.
	Gradual deterioration	57	Adenocarcinoma	Died	Diagnosis suspected before first operation and almost certain at the second, because of stony hardness of growth and absence of cleavage planes; carcinomatous deposits in upper part of left femur.
va-	Uneventful	27	Adenocarcinoma	Operative recovery	Apparently well on discharge.
tion	Uneventful	33	Carcinoma	Operative recovery	Metastasis in left femur; prostate extremely hard; function of urination re-established after operation and death a year later from general deterioration and metastases.

between the two operations. During this time the patient was repeatedly examined and had gained so much in strength that he was walking about like a well man. The result was naturally most disappointing.

It appears to me that hiccough is in these cases a symptom pointing to renal or cardiorenal insufficiency.

NOTE.—After the meeting one of my colleagues privately expressed the opinion that the three fatal cystotomies should have been counted among the two-stage cases of prostatectomy. On arguing the matter with a number of others, I have come to the conclusion that these three cases should in truth not be counted at all, since they were not operations upon the prostate. In the anteprostatectomy days suprapubic cystotomy was common as a relief measure—and this operation had a very considerable mortality.

For the sake of completing the statistics then there may be counted 37 cases of one-stage operations upon the prostate—not 40—with 16.21 per cent. mortality. The mere matter of intention cannot change the fact that no prostatic operation was done.

TABLE OF MORTALITY.

Case No.	Cause of Death.	One-stage.	Two-stage.	Number of Days after last Operation.
2	Uræmia ("gradual deterioration")	1	....	10
10	Uræmia	1	....	6
40	Uræmia	1	....	5
1	Shock (hemorrhage)	1	....	1
74	Shock (hemorrhage), carcinoma	1	....	5
7	Shock	1	....	1
75	Shock (carcinoma)	1	....	1
28	"Collapse," no hemorrhage	1	....	2
30	Cardiorenal	1	....	3
72	Cardiorenal	....	1	8
35	Cardiac	1	....	1
16	Coma (diabetic)	1	....	4
70	Pneumonia	....	1	3
78	Gradual deterioration (carcinoma)	....	1	50

A METHOD OF EXPOSING THE LOWER END OF THE URETER.

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THE method herein described of approaching the lower part of the ureter has been employed in operating on six cases in our clinic. So far as I have been able to learn, the method has not been previously reported, and because of the many difficulties encountered in removing a small stone caught in the part of the ureter which runs through the wall of the bladder, a short description of this procedure seems not out of place.

The first patient operated on was a boy eighteen years of age with diverticulum of the bladder. The diverticulum was about three inches long and one inch in diameter and communicated with the bladder by an opening about one-half inch in diameter in front of the meatus of the left ureter. At the cystoscopic examination, a spurt of urine could be seen at the edge of the opening into the diverticulum, but a catheter was introduced into the ureter with great difficulty, evidently because of the deformity produced in the ureter by the diverticulum. The symptoms in this case were very suggestive of diverticulum and the diagnosis was confirmed by the cystoscope.

Operation.—The patient was placed in a moderate Trendelenberg posture and a median suprapubic incision made from the symphysis to the umbilicus, extending through the fascia between the recti muscles down to the peritoneum. The peritoneum was not opened but was brushed back from the fundus of the bladder in the usual way, the bladder lifted well forward and opened after the suprapubic space had been packed off with gauze. The bladder was opened in order to explore and pack the diverticulum to facilitate in removing and also to determine if possible the rela-

tionship of the diverticulum and ureter so that the ureter would not be injured in removing the pouch. This, however, could not be satisfactorily accomplished from within the bladder and with the wall of the left side of the bladder held firmly by an assistant, dissection was carried down to the base of the bladder, exposing and freeing the ureter for 2 or 3 inches. The ureter was held to one side while the diverticulum was separated from the surrounding fatty tissue and removed. The opening in the bladder was closed with the ureter in sight so that it could not be injured or its lumen interfered with. Two small rubber tissue drains were left down in the space at the side of the bladder where the diverticulum had been. These drains were removed on the third and fourth days. There had been no drainage of urine; just a little serum. The entire wound healed practically by primary intention and the patient was up and around in ten days and made a complete recovery. A letter from him two months after the operation states that he is well.

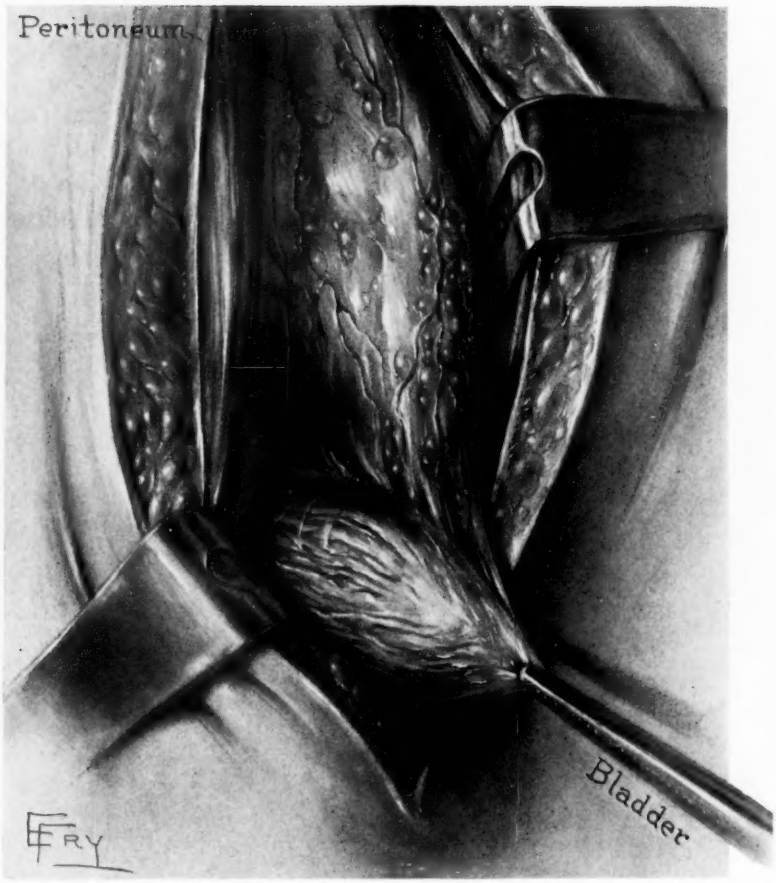
In the second and third cases, the operation was performed for stones in the lower ureter. In the second case a small stone was firmly lodged in the lower end of the right ureter. The Röntgenogram and the cystoscopic examinations confirmed the diagnosis. The patient, a female, aged thirty-one years, had been having repeated typical attacks of colic.

Operation.—The ureter was exposed as in the preceding case with the diverticulum, except that the bladder was not opened. As soon as the peritoneum had been reflected from the bladder for a little distance the right side of the bladder was retracted toward the midline and held firmly. After a very little dissection through the fat toward the base of the bladder, the stone could readily be felt. Before manipulating the stone the ureter was freed for an inch and a half or two inches above the bladder and a pair of tacking forceps were clasped across the ureter. This was done to prevent the stone from slipping up the ureter in case it became dislodged. The stone was then grasped between the fingers and removed through a small longitudinal incision in the ureter. No attempt was made to suture the opening. A rubber tissue drain was inserted and removed on the fifth day. There was

FIG. 1.

Showing regular suprapubic incision, with bladder lifted up. Peritoneum and fat have not been dissected from top of bladder.

FIG. 2.



Shows same incision with the peritoneum and fat dissected off. The bladder is held to one side by soft forceps which do not grasp the muscular wall of bladder.

FIG. 3.

Bladder held well to the side. Dissection through the fat shows seminal vesicle running above the ureter. Ureter dissected free for an inch or more and grasped by tacking forceps, which do not compress wall of ureter but close it together to prevent stone slipping back if it becomes dislodged.

little, if any, leakage of urine and the patient made a satisfactory convalescence.

In the third case, in addition to the attacks of colic due to the stone in the ureter, which was shown also by both Röntgen and cystoscopic examinations, there was also conclusive evidence of previous and recent attacks of appendicitis. In this case the patient was a male, aged twenty-seven years.

Operation.—As in the previous cases, the incision was made in the midline between the recti muscles. In this instance, however, it was continued through the peritoneum, and the appendix, which was subacutely inflamed, was removed. The stone in the right ureter about 4 inches from the bladder could readily be located by exploring from within the peritoneal cavity. After the appendix was removed, the opening in the peritoneum was closed and protected by gauze pads. The ureter was exposed as in the previous cases and a stone about a half inch long and a third of an inch in diameter was removed. The usual rubber tissue drains were left in the wound for several days. In this case there was drainage of some urine through the wound at first but the wound was entirely closed within ten days.

Besides these two cases of stone in the ureter and the one of diverticulum of the bladder, the method has been used to expose the ureter in three cases of extraperitoneal resection of the bladder for cancer. In these three cases the resections were for the removal of a considerable portion of the bladder which contains one of the ureteral openings, and it was necessary to expose the ureters at this point outside of the bladder in order to transplant them satisfactorily.

With our limited experience, thus far this technic seems to have some advantage over the other methods, especially for the removal of stone. The search for the ureter may be quite tedious, though if it contains a stone, as in our two cases, it can be located by using the stone as a guide. In the female the uterine artery will usually be exposed; in the male, the seminal vesicle may at first be taken for the ureter, though the difference will soon be discovered.

RECTOVESICAL ECHINOCOCCUS CYST.*

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THE usual sites of implantation and growth of echinococcus disease have long been noted and the surgical indications satisfactorily worked out. It is only when the disease presents bizarre features that it assumes importance of sufficient interest to warrant a record of the case. On such grounds the case about to be detailed seems qualified for publication.

An Italian, thirty-five years of age, was brought to me by his physician, on September 21, 1913, with the diagnosis of an enormous vesical calculus. The diagnosis had been arrived at after radiograph examination. The patient was greatly emaciated and his chief complaint was frequent urination and intense pain in the glans penis. The abdomen was distended by a tumor occupying the hypogastrium, whose upper limit was midway between the ensiform and navel. Percussion and palpation of the tumor indicated it to be a greatly distended bladder. Rectal examination showed a marked bulging of the tumor in this situation, compressing the rectum. Bimanually the tumor felt cystic, a soft rubber catheter passed to the bladder without obstruction, and six ounces of clear urine was obtained.

Cystoscopic examination was impossible, the reason of which will be shortly appreciated. The previous history of the patient did not add much. He had been losing weight and strength for months, the abdomen had been steadily increasing in size and the above mentioned vesical symptoms in severity.

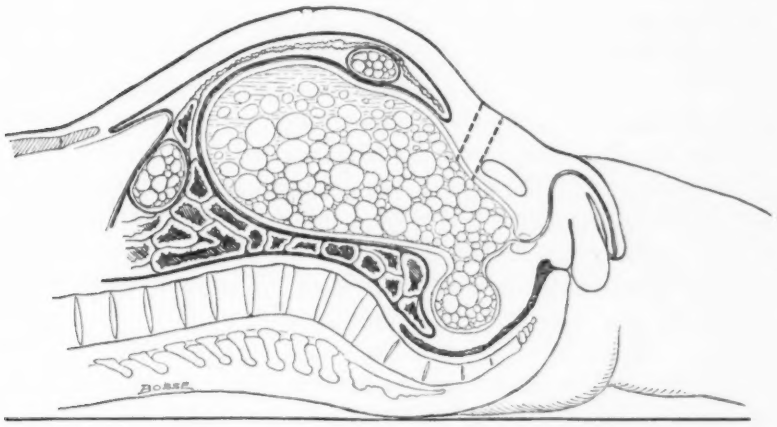
The radiograph submitted by his physician showed at a glance that a faulty interpretation of the findings had been made.

The shadow mistaken for a calculus being outside the bladder area, cystotomy was decided upon and accomplished under a

* Presented before the New York Academy of Medicine, Genito-Urinary Section, November 19, 1913.

whiff of nitrous oxide anæsthesia, the patient's condition not admitting of any prolonged anæsthesia or exploratory operation (see Fig. 1).

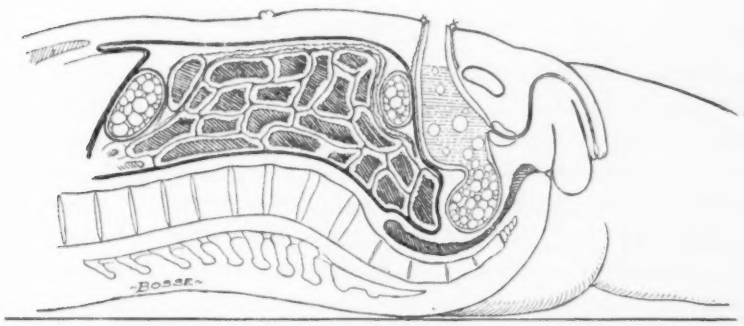
FIG. 1.



Original condition. Rectovesical cyst, cyst distended bladder, cyst on liver surface and cyst of omentum.

As soon as the bladder was incised multitudes of echinococcal daughter cysts forced themselves out of the bladder. The incision was enlarged and between two and three hundred of these cysts were evacuated from within the bladder.

FIG. 2.



Condition after first operation. Bladder sutured to skin for drainage.

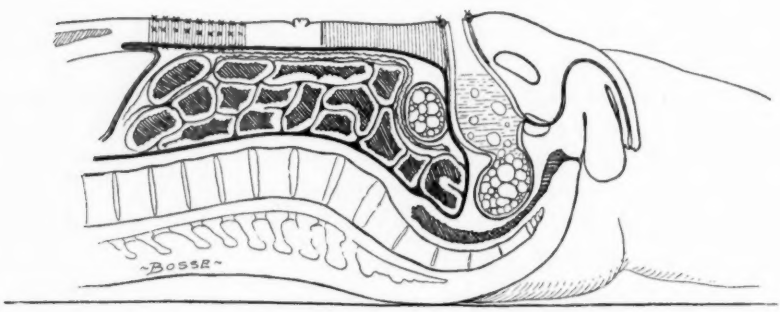
The patient's condition being precarious it was decided to omit an extensive search for the mother cyst, contenting one's self with suturing the bladder to the skin and providing for constant drainage (Fig. 2). The patient, following operation, im-

proved from the start. The evacuation of the cyst-filled bladder caused disappearance of the main tumor, and made possible further examination of the abdomen by palpation. Such examination revealed a tumor mass, situated in the region of the right epigastrium.

As speculation had been rife as to the manner the echinococcal disease had invaded the man's bladder, the finding of this mass offered a possible explanation; namely, that the disease was primary in the kidney and the bladder had been involved by cysts passing down the ureter. More careful examination of this right-sided mass, however, made one suspicious that it might as well be connected with the liver as the kidney.

Ten days after the cystotomy the right kidney was explored

FIG. 3.



Condition after second operation. Liver cyst removed.

and found to be normal, the mass being situated within the peritoneal cavity. An anterior incision was then made through the right semilunaris over the region of the hepatic notch. The tumor was found adhered to the edge and under surface of the liver. It was carefully dissected away without opening its capsule and was about the size of a large orange. It proved to be an echinococcus cyst. The patient recovered from operation without incident but the cause of the bladder condition remained, as yet, unsolved. One week following this, a third operation was undertaken to close the urinary bladder and for further investigation. At this time it was still possible to fish daughter cysts out of the bladder through the suprapubic opening (Fig. 3).

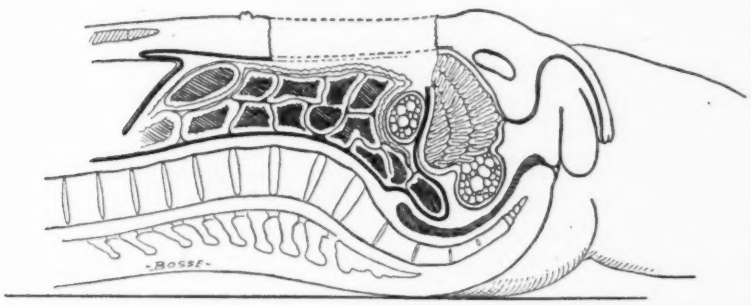
Preparatory to this final operation the bladder was tightly packed with iodoform gauze and the patient placed in the

Trendelenburg position. The peritoneal cavity was opened by a median abdominal incision running upward from the suprapubic incision (Fig. 4).

The omentum was adherent to the peritoneum covering the fundus of the bladder and a small echinococcus cyst was discovered at the point of adherence on the right side. This cyst was excised without rupture.

The attachment of the bladder to the skin (result of first operation) was loosened and the peritoneum stripped off the fundus of bladder. The existing incision in the bladder was carried around behind and a perfect view of its interior obtained. The bladder was found free of cysts or of cyst wall detritus, but an opening was discovered in the trigone about the size of a half dollar. This opening communicated with a large mother cyst,

FIG. 4.



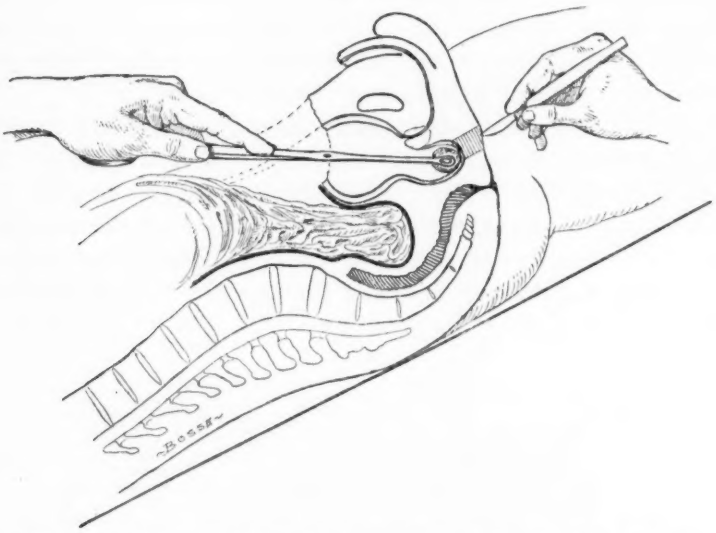
Third operation, first step. Removal of cyst of omentum (bladder packed with gauze

situated between the rectum and bladder below the peritoneal reflection. The mystery was at once cleared up: The daughter cysts were being manufactured in the mother cyst and the urinary bladder had been used as a storehouse for them until nature had objected to the overcrowding. From this point on, the surgical management of the case was as follows: A sponge holder, carrying a small gauze wipe, was introduced into the mother cyst through the opening in the floor of the bladder and then pushed down towards the perineum. A perineal dissection was then made between rectum and prostate and the cyst capsule pulled down, incised, and sutured, to the skin of the perineum (Fig. 5).

Through this perineal opening the mother cyst was curetted and pure carbolic acid applied to its wall.

The communication between cyst and trigone was closed, after freshening the edges, by catgut sutures, leaving a small opening

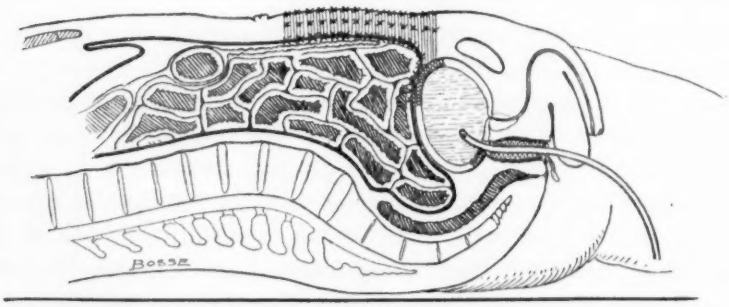
FIG. 5.



Third operation, second step. Mother cyst incised through the perineum.

at the lower angle of the wound through which the bladder was drained. Drainage was carried out by inserting a 26 French

FIG. 6.



Third operation, final step. Cyst wall sutured to skin of perineum. Opening between bladder and cyst closed up to catheter inserted for drainage. Wound in fundus of bladder closed without drainage. Peritoneum and abdominal wound closed.

catheter from the perineal wound, through the cyst cavity into the bladder. The suprapubic bladder wound was completely

closed. The peritoneum was sutured closing peritoneal from perivesical space, and the abdominal incision closed without drainage (Fig. 6).

The operation was tedious but the patient recovered without reaction. The perineal tube was removed at the end of four days and the bladder wound healed quickly. The cyst cavity was irrigated with iodine solution and rapidly contracted.

The abdominal incision healed by first intention.

The patient has steadily gained in strength and is relieved from his malady.

FRACTURE OF THE PENIS.

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INJURIES of the penis, occurring as the result of the ordinary accidents, incident to the carrying on of our daily life, are fairly common. These include contusions and hæmatomata, and tears and lacerations of the body of the organ, usually communicating with the exterior, either through the outside skin, or very frequently through the urethra, the tear in the latter cases extending from within the canal outward. These injuries may be the result of a fall astride a fence or other sufficiently large object, or the result of a kick or blow, directed at the genitalia. Whenever a tear extends through the urethra, the urethral lesion should be regarded as the principal one.

Subcutaneous rupture of the penile body, or fracture of the penis, occurring during intercourse, is a most unusual accident, and of such an unfortunate happening, we have recently had an example at our clinic in the Mount Sinai Hospital Dispensary.

CASE No. 950, series of 1912.—A very thoroughly frightened Italian, thirty-six years old, appeared at the clinic, with the story that early that morning, during intercourse with his wife, he had experienced a sudden severe pain in his penis, that he had withdrawn it immediately thereafter, and that it had then swollen very quickly, and had assumed the shape and appearance shown in the accompanying drawing (which is about one-half the actual size of the damaged organ). The patient was able to void voluntarily, the resulting urine being free from blood. Three months previously, he had had an attack of gonorrhœa, and had been treated only indifferently well; there had been no complications.

FIG. 1.

Ecchymotic infiltration swelling of penis after subcutaneous rupture (fracture of the penis).

He had been told, that for his present trouble an amputation of the penis would be necessary.

A word in regard to the anatomy of the penis may not be amiss. It is made up of three bodies, which histologically are composed of erectile tissue. The two dorsal bodies, or corpora cavernosa, are side by side, separated by a very dense and firm fibrous septum, and together they furnish the groove, on the ventral side of the organ, which receives the third body, or corpus spongiosum. Each body has a similar structure, that is, a mass of erectile tissue, contained in a strong envelope, made up of connective tissue fibres, smooth muscle cells, and elastic fibres. The tunica albuginea of the dorsal bodies is very thick and strong, that of the spongy body is thin and weak, and shows a predominance of elastic tissue and smooth muscle cells. The reason for this is apparent when we remember that the corpus spongiosum lodges the canal of the urethra, there being a distinct strata of smooth muscle cells directly surrounding the canal. The relative thinness of structure of the sheath of the spongy body furnishes a point of election for the reception of injuries; its proximity to the canal of the urethra, inflammatory changes, which predispose to their occurrence.

The term "fracture" as applied to this condition is a misnomer, inasmuch as it implies a lesion of bone. In the human subject, there is no os penis, a condition which is regularly found in some of the lower animals. In these animals, curiously enough, fracture of the penis never occurs. In the human subject, we occasionally come across patients, who have collections of bony tissue of larger or smaller degree, usually gathered either in the septum, or in the tunica on its dorsal aspect. These are not true penile bones, but pathological conditions, the result almost always of syphilis, in combination with a local continuous irritative trauma, as from the wearing of a corset.

In the *Fortschrifte auf dem Gebiete der Roentgenstrahlen,* for 1903, Brohl cites a case of a young man of twenty years, with an os penis. The X-ray photograph shows the shadow of a central column with two lateral

branches, composed of bony tissue. A true os penis is a thin pencil shaped bone, pointed at its free extremity, and broader at the root of the organ. The case cited is evidently one of syphilitic calcification of the fibrous septum.

One finds very little regarding this condition in the literature of medicine. It is first mentioned in 1849, in the *American Journal of the Medical Sciences,* the article being referred to in *La Gazette des Hopitaux,* of the same year. Prior to 1887, there are but five references to this lesion, and since then the references are few and far between.

There is no point of election for the position of the fracture. It may be at the centre or at either end of the penis. The tear always takes place when the organ is in the erect condition. Owing to the fact that the tunica of the spongy body is weaker and thinner than that of the corpora cavernosa, the tear almost always begins in the former, and may or may not extend into the latter. It is never very deep, for the reason, that as soon as the tunica begins to tear, the erectability of the penis is immediately disturbed, the organ becomes flaccid, and the tearing process, of necessity, stops. The tear as a rule does not extend through into the lumen of the urethra; and whenever we find free bleeding from the meatus, the lesion is a laceration of the urethra, with the tear extending for a short distance into the substance of the spongy body. One should not confuse these two conditions, as one is very apt to do, in looking through the literature.

Free bleeding always occurs under the skin, and a large hæmatoma forms; in addition the penis enlarges enormously from an associated œdema. At the line of fracture, a bending of the organ takes place; this may be very acute, as in the case reported herewith. It occurs mechanically, owing to the fact that the penis becomes longer on the torn side. Of course the concavity of the deflection is toward the untorn side.

When the process is not disturbed, the hæmatoma is slowly absorbed, and is replaced by a hard scar. Deformity, of more or less extent, usually persists; and the power of erection is

lost in all but the least severe cases. Sometimes, even in the bad cases, the penis may regain this power, but it then does so in two stages: the part posterior to the lesion becomes erect, and following that, the part anterior is distended with blood.

One frequently sees men, in the organs of whom one can feel small shot-like bodies, attached to the tunica albuginea, and freely movable under the skin. These are the scars of small hæmatomata, resulting from minute lacerations, which were practically symptomless.

Most of these patients give a history of one or more attacks of gonorrhœa, and in these it is found that the inflammatory process has spread outside the urethra, and has infiltrated the fibrous septa, and so formed a locus minoris resistentiæ for the occurrence of these lacerations. Infection of the hæmatoma is rare, and if it should become infected, the matter may become very serious: gangrene of the tissues may take place, and sloughing occur.

The lesion occurs almost always during coitus; it has been known to occur during masturbation. At the moment of happening, a distinct cracking noise may be audible; there is sudden intense pain, and the organ immediately becomes flaccid. Within a few minutes, however, it begins to enlarge, and attains a perfectly enormous size. This is due to the associated œdema. The primary pain is succeeded by a painful sense of fulness. Ecchymosis is very marked. The lesion is typical: the organ bent on itself, the enormous size, the subcutaneous extravasation of blood. The absence of bleeding from the meatus distinguishes it from laceration of the urethra.

The line of treatment followed out in the past has generally been an expectant one. The patient has been kept in bed, and cold compresses have been applied locally. Fair results only have been obtained. Legueu and Michon recommend exposing the site of fracture, turning out the clots, and approximating accurately, by suture, the torn surfaces. They claim that no deformity follows, and there is better expectation of the penis regaining its power of erection.

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POST-OPERATIVE ILEUS.

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THE term "ileus" as applied to post-operative conditions may mean an obstruction to the onward flow of intestinal contents due to one of two causes: first, mechanical, which includes all kinks and twists in the bowel, adhesions constricting the lumen, strangulations by internal and external hernia and the like; second, paralytic, which in reality is not an obstruction but simply an inability of the bowel to propel its contents onward; in other words, a stasis.

The clinical pictures in both varieties are identical. The classical symptoms of pain, vomiting, meteorism and coprostasis are in each case the same. In the mechanical variety the cause is evident; in the paralytic it is as yet undetermined, for we do not know upon what factor or factors paralysis of a greater or lesser extent of the musculature of a bowel does depend. Infections, nerve interference, and extreme traumatism to the intestines with injury to the mesentery, sometimes causing thrombosis of its vessels, have been given as etiologic factors. Nor does this matter for our present purpose, for we are concerned, not with the cause of the paralysis, but with how to prevent the direful condition it produces from becoming rapidly fatal; in other words, how to overcome it, once it is present.

About five years ago, while experimenting on dogs to determine whether the anatomic site of the obstruction played a definite part in the time required to produce death, we were somewhat surprised to see that some of the dogs died without apparent signs of peritonitis. Later, at necropsy we observed this same condition in several cases of post-operative ileus. The interesting question was and is to-day, what is the direct

cause of death in these cases? Up to date an extensive literature has grown up on this subject, but there appears to be as yet no unanimity of opinion.

The theories advanced as a cause of death in ileus uncomplicated by peritonitis are, that it is an auto-intoxication due to an absorption of toxins from decomposing intestinal contents; that it is a bacteræmia of a septicæmia; that it is due to an absorption of an altered chemically toxic secretion of the duodenum; that it is due to a reduced blood-pressure, an exhaustion or a collapse, brought about by the enormous loss of fluids from the blood- and lymph-systems, caused by the increasing intestinal transudation, in time producing anæmia or a devitalization of important centres in the brain; or that it is a reflex phenomenon due to an irritation of the central nervous system.

The prevailing impression in regard to the cause of death in ileus seems to be that it is a toxic condition originating from the absorption of bacteria or their toxins or from the absorption of some altered physiologic secretions of the pancreas, liver and intestinal mucosa. If this is so, it ought to be possible, in some manner, to demonstrate such poisons experimentally.

For our experiments dogs were used. Obstruction of the bowel was performed high, that is about 8 inches from the pylorus or about 2 or 3 inches distal to the opening of the bile and pancreatic ducts.

Dogs with complete obstruction of the bowel at this point, uncomplicated by peritonitis, lived from 40 to 108 hours, the average time being about 69 hours. For from 30 to 40 hours after the obstruction was produced, the animal would move about. The clinical syndrome in each case was typical. There would be vomiting and after 40 hours the animal would lie down most of the time. Muscular tremors, localized in certain groups of muscles, would appear. A certain muscular stiffness could also be noticed in certain cases. The animal would remain between a semicomatose condition and death for two, three and even four days. The overfilled stomach would

often partly empty itself, not so much by an act of vomiting on the part of the dog but more properly speaking by an overflowing.

The temperature of an "ileus dog" was not characteristic. There would be a slight rise during the first and second days following the artificial obstruction, after which it would return to normal and quickly become subnormal. The temperatures were all taken by rectum. The normal temperature of a dog is from 101 to 102° F. It would rise to about 102.5 or 103° F. and on the third and fourth days and just before death it would not register over 92° F. The pulse was always accelerated somewhat. The pulse-rate ranged from 100 on the first day to between 120 and 130 on the third and fourth days.

In a series of five dogs complete blood examinations were made before operation and twice daily after operation. We thought that some definite change in the blood-picture might be noticed; but on finding this quite constant, not characteristic and not different from that which is observed in other conditions, we abandoned these entirely. There would be a slight leucocytosis at first, then a gradual fall to normal and subnormal.

With these brief preliminary remarks we shall now cite our experiments.

First Series of Experiments, Injections of Duodenal and Stomach Secretions.—The duodenal and stomach secretions, that is, the secretions above the point of obstruction, were tested as regards their toxicity. For this purpose guinea-pigs were used. The secretions were filtered first through porcelain filters. Cultures taken from the final porcelain filtrate still showed the presence of bacilli and cocci. Half of the filtrate of the secretion of each dog was then sterilized by heat at 100° C. (212° F.) for from thirty to fifty minutes. The other half was used without sterilization: 1.5 c.c. of the sterilized and 1.5 c.c. of the unsterilized filtrate were then injected subcutaneously into guinea-pigs. At the point of the injection of the unsterilized filtrate sloughs developed, but in no instance did the guinea-pigs show any evidence of toxæmia. For three or four days after the injection, the guinea-pigs seemed lively and normal. In all ten dogs and twenty guinea-pigs were used.

The amount injected, 1.5 c.c., is a small amount, but 1.5 c.c. for a guinea-pig would, weight for weight, be equivalent to about 360 c.c. (about 12 ounces) for a man weighing 150 pounds. Besides guinea-pigs, one dog

weighing 7 pounds was used. The intestinal contents were filtered through filter-paper, and with the filtrate as a diluent a 4 per cent. tricresol solution was made; 40 c.c. of this solution were then injected subcutaneously. (This amount, for a dog weighing 7 pounds, is equivalent to about 3.5 c.c. for a guinea-pig and 850 c.c., or about 28 ounces, for a man weighing 150 pounds.) This solution, if at all toxic, certainly ought to show its toxicity in some form or other when injected into animals in such large proportions.

Second Series of Experiments, Injection of Serum.—If the dogs died of toxæmia, the toxic material, whatever it might be, must be circulating in the blood-stream in order to cause its fatal effects. Whatever is in the stomach or bowel is, so to speak, outside of the body. For this reason the toxicity of the serum of the ileus dogs was tested. The first dogs were allowed to die, but, as after death it was difficult to withdraw a sufficient amount of blood from which to separate out the serum, the dogs used later were allowed to live 48 hours (at which time their symptoms seemed most severe) and then bled to death.

Cultures were made from the blood, serum and peritoneum of all these animals, and in each case in which the peritoneum showed an absence of bacteria the blood and serum gave the same negative result. When peritonitis was present (which animals were not used) bacteria resembling the colon bacillus and *Staphylococcus albus* could also be demonstrated in the cultures taken from the blood of these animals. Such positive results were not, however, constant. The serum of ten dogs was injected into twenty-five guinea-pigs subcutaneously and peritoneally. From 1.5 c.c. to 3 c.c. were used. Whether the intraperitoneal or subcutaneous injection was used seemed to make little difference. The guinea-pigs that received 3 c.c. died; about half of those that received 2 c.c. died and the others remained well and lively; only one of those that received 1.5 c.c. died.

In the process of the clotting of blood, the leucocytes, as is well known, are squeezed on and certain enzymes are forced out of their protoplasm. It was thought that the enzymes might have some neutralizing effect on the toxins circulating in the serum, if any such there are. For this reason the blood was prevented from clotting by allowing it to run, while bleeding, directly into a 1 per cent. solution of sodium citrate. Equal parts of blood and sodium citrate solution were used. The mixture was then centrifuged. Of this mixture of sodium citrate and serum, 4 c.c. were injected into six guinea-pigs. (Serum from three different dogs was used.)

This mixture had about the same effect as did the plain serum. One guinea-pig died; the five remaining continued lively and well. The guinea-pigs were observed for about five days and then released.

What was the cause of the varied outcome of these injections of "ileus serum"? Is dog serum a foreign protein for guinea-pigs and does the injection of such foreign protein cause anaphylaxis? If it does, normal dog-serum ought to have the same effect and this, we learned later, is precisely what normal dog-serum will do. Testing normal dog-serum on guinea-pigs we found that over 2 c.c. will invariably kill; that 2 c.c. and

even 1.5 c.c. sometimes kills. This is exactly what the serum from the "ileus dogs" had been doing.

Instead of guinea-pigs, small dogs were now used. Of course, the amount of the corresponding injection had to be increased. The equivalents of from 2 to 4 c.c. to a guinea-pig weighing 300 gm. were injected. One dog weighing 7 pounds received 40 c.c.; one dog weighing 10 pounds received 50 c.c. and another weighing 14 pounds received 40 c.c. As far as could be observed, these injections of serum from ileus dogs into normal dogs had absolutely no effect. In like manner two rabbits were used with a negative result.

Third Series of Experiments, Injections of the Supposedly Toxic Gas Elaborated in the Stomach and Intestines.—At intervals varying from 48 to 60 hours after the artificial obstruction, a series of seven dogs was killed; 140 c.c. of gas by volume were extracted from the stomach and duodenum with an old-fashioned screw plunger aspirator, and the whole (that is, 140 c.c.) injected into the intraperitoneal cavity of normal dogs weighing, on an average, 25 pounds. The absorption of this gas, as we detected from subcutaneous injections in another series, is completed in about 24 hours. In no instance did the recipients of the gas show signs of toxæmia. Their temperature became slightly elevated for a few hours, but aside from this the findings were negative. There were no evidences of either vomiting or of peritonitis. These dogs seemed normal in every way. They were observed for six days and then released.

If in ileus there is an absorption of toxins, where are the toxins? Toxins, in order to have a deleterious effect on the body, must reach the central nervous system, at least the respiratory and circulatory centres; and how can they reach these centres if they are not brought into contact with them by the serum of the blood? Can they be contained in the corpuscular elements of the blood? If so the introduction of a large amount of a supposedly toxic blood, *en masse,* into a normal animal ought to produce some symptoms in that normal animal corresponding to those it produced in the abnormal animal from which it was taken. This again we were unable to demonstrate in a fourth series of experiments.

Fourth Series of Experiments, Direct Transfusion of Blood.—The carotid artery of an ileus dog was exposed 48 hours after the onset of ileus. The jugular vein of a normal dog was next exposed and 50 c.c. or nearly 2 ounces of blood were withdrawn. A cannula was then connected from the carotid artery of the ileus dog to the jugular vein of the normal dog and the former bled to death into the latter. The normal dog was carefully weighed immediately before and immediately after each transfusion,

for by this method alone we were able to judge just how much "ileus blood" it received. This procedure was repeated seven times. In the first three cases both dogs were anæsthetized with ether, but the ether anæsthesia, in itself a toxæmia, caused vomiting and stupor and therefore interfered with correct deductions; local anæsthesia was then used, and in every case after the transfusion was completed the dog would jump up, be as lively as before and continue in the same state, absolutely normal. The amount of blood the normal dog received varied somewhat. As will be seen from Table I, the average weight of the recipient dog was 13½ pounds and the average amount of ileus blood he received was $13^{2}/_{5}$ ounces.

TABLE I.—RESULTS IN EXPERIMENTAL DIRECT BLOOD TRANSFUSION.[1]

Weight of dog before transfusion.	Weight of dog after transfusion.	Amount gained after 50 c.c. or 2 oz. blood withdrawn.	Amount in c.c. of ileus blood normal dog received.
Pounds	*Pounds*	*Ounces*	*c.c.*
17	17½	10	300
15	16	18	540
15	16	18	540
13	13¾	14	420
10	10¼	6	180
11	11½	10	300
15	16	18	540
Total..96	101	94	2820
Average..13.7	14.4	13.4	402.8

The largest amount was 540 c.c. (18 ounces) and the smallest was 180 c.c. (6 ounces). The normal amount of blood in a dog weighing 13.5 pounds, the average weight of the recipient dog, is about 15.4 ounces. By volume, therefore, the amount of ileus blood (402.6 c.c. or $13^{3}/_{10}$ ounces) the recipient dog received was 2 ounces less than the normal amount of blood contained in that dog.

If the ileus blood which the normal dog received contained some toxic substance surely the reception of such a large amount ought to cause symptoms similar to those observed in the ileus dog. This was not the case. There was not even vomiting and the dog soon after apparently ate a hearty meal. It might be interesting to observe that the average amount of blood the dog received in the transfusion would, in a man weighing 150 pounds, be equivalent to 4½ quarts.

After reviewing these experimental facts can we still hold that death in ileus is due to a toxæmia? We have been unable to demonstrate bacteria in the blood, and likewise by injecting the duodenal and stomach contents, by injecting the serum, by injecting the gas elaborated, and lastly, by direct transfusion

[1] McLean and Andries, Journal A.M.A., Nov. 2, 1912, page 1614.

of the blood, we have also been unable to prove the presence of bacteria or any other toxic substance. Besides this, absorption from the bowel in ileus is considerably diminished. Braun [2] has proved this very conclusively by injections of solution of strychnin sulphate into the proximal portion of the bowel. He concludes that absorption of the strychnin is less rapid than normal even from the onset of ileus. (He based his deduction on the intervals between the injections and the appearance of convulsions and death.) In some cases the progressive diminution in absorption is so great and the consequent absorption of strychnin so slow, that the injection of more than a toxic dose of strychnin will not cause convulsion and death. In other words, in spite of the excessive dose of strychnin, the animals expire as usual from induced ileus and not from strychnin poisoning. From these experiments he concludes that in ileus the absorption from the bowel is lessened in all cases and in some stages of the disease is entirely absent.

If an ileus death is not due to toxæmia, to what is it due?

A striking thing that was noticed in the animals that died of an experimental ileus is the loss of weight (see Table II).

TABLE II.—AMOUNT OF WEIGHT LOST IN THE COURSE OF AN ILEUS DEATH.

Time in which death occurred.	Weight before operation.		Weight 2 hours after operation.		Weight 24 hours after operation.		Weight 48 hours after operation.		Weight 72 hours after operation.		Weight 96 hours after operation.	Weight 108 hours after operation.	Weight at death.	
hours	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*lb.*	*lb.*	*oz.*
75	26	4	25	8	25	..	24	..	21	8	*	*	21	8
108	25	..	22	12	21	8	21	8	21	..	19	19	19	..
72	15	..	15	..	15	..	14	..	13	..	*	*	13	..
48	21	..	21	..	19	..	17	8	*	..	*	*	17	8
48	11	..	11	..	11	..	10	8	*	..	*	*	10	8
60	14	8	13	8	..	..	12	..	*	..	*	*	12	..
72	15	4	15	..	14	8	13	..	12	..	*	*	12	..
40	44	8	41	4	..	..	38	12	*	..	*	*	38	12
72	21	..	21	..	..	..	20	..	19	..	*	*	19	..
72	22	..	21	..	..	..	20	..	19	8	*	*	19	8
72	20	..	19	..	..	..	17	..	16	8	*	*	16	8
Total....739	235	8	225	..	..	..	208	6	..	..	..	..	199	4
Average.. 67	21	2	20	1	..	..	18	15	..	..	..	..	18	1

[2] Braun, Ztschr. f. Chir., 1908, xcvi, 544.

* Dead.

The dogs lived from 40 to 108 hours, an average of 67 hours, and during that time the weight lost was from 1 to 5½ pounds, the average being a little over 3 pounds. Some of the dogs had a full stomach at the time of operation, and if we deduct the weight of the vomitus during the first two hours after the operation, that is, the amount of food débris contained in the stomach at the time of the operation, the average amount of weight lost would be 2 pounds.

For animals weighing on the average of 20 pounds, that is, the average weight of the animal two hours after the onset of ileus, the loss of 2 pounds is quite considerable. It is a loss of about one-tenth of the whole body weight. This in a man weighing 150 pounds would be the equivalent to a loss of 15 pounds and that in the short space of three days. This loss of weight must be attributed principally to a loss of body fluids that have been discharged through the bile passages and pancreatic ducts and that have otherwise transuded through the intestinal mucosa, and have been expelled as vomitus and urine.

When we consider that the proportion of blood to the other elements of the body is, weight for weight, about one-fourteenth, and that the loss in ileus animals is about one-tenth, all due to the loss of fluids, then we can readily understand how this must have a detrimental effect on all the body functions. It must certainly have an enormous effect on the blood-pressure.

We have not conducted any experiments on the blood-pressure of dogs dying from ileus, but Braun [2] showed very conclusively by a long series of experiments that the death of dogs that died from ileus without peritonitis differed in no way from that of those that were bled to death slowly. Besides the blood-pressure, which in each case was similar, the general clinical picture, he asserted, except for the vomiting in ileus animals, was also similar. Accordingly, the disordered functionating power of the bowel, with its direct depleting effect on the abdominal blood-vessels and consequently on the whole vascular and lymph system, causing a steady sinking blood-pressure, and a necessary consequent disturbance in the cerebral

circulation, most evident in the circulation of the vital centres, can be looked on as one of the prime factors of the direct cause of death in ileus.

Hartwell and Hoguet[3] have demonstrated the fatal effect of loss of fluids in ileus most conclusively by a series of experiments in which life of ileus dogs was sustained indefinitely by the subcutaneous injection of saline. To quote from these authors: They conclude "that if a quantity of normal saline solution, slightly in excess of the total loss of water in the urine and vomitus, be given daily in the form of hypodermoclysis, the ileus dogs promptly return to the condition of a dog undergoing simple starvation. Dogs so treated have lived in excellent health for a period of three weeks and more, showing at the end of that time every indication that they would have lived much longer if the treatment were continued."

Besides this loss of fluids, the sympathetic nervous system must play an important rôle. If a severe blow on the solar plexus can occasion death, is it not probable that such grave changes as are caused by ileus in the abdominal viscera, the organs directly supplied by the sympathetic or solar plexus, may set up similar reflexes with a similar result? Of course, concerning the sympathetic nervous system little is known definitely and absolute proof of the effect of ileus on this system is wanting. That such a hypothesis may be correct we will not deny. That a toxæmia, however, is the cause of death in ileus in the face of the experiments enumerated, is hardly tenable.

Interesting as it is to know exactly on what factors death depends, such knowledge is at the same time practical. In the beginning we stated that we were concerned in preventing the direful condition ileus produces from becoming rapidly fatal. This can be done in a large percentage of cases if a practical application of the knowledge, gained by our experimental studies, is made. If we look on the disturbed functionating power of the bowel and the failing circulation that results there-

[3] Hartwell, John A., and Hoguet, J. P.: Experimental Intestinal Obstruction.

from as the source of the clinical picture of ileus, then our efforts must be directed toward these factors. Rational treatment must therefore, first, subdue the distention, which is continually increasing and at the same time increasing the paralysis of the bowel, in the same manner as overdistention of the bladder brings on a paralysis of the musculature of this viscus, and, secondly, it must replace the lost fluid in the vessels. The former condition, the distention, can often be relieved in mild cases by stomach lavage and enemas, but in severe cases, surely by ileostomy. Ileostomy, by relieving the distention in practically an instant, allays at the same time the irritation in the paralyzed gut and so inhibits the further influx of blood to the abdominal blood-vessels; the latter condition, the lost fluid or the exsanguination that has taken place, can only be restored by a refilling of the vascular system. This can best be accomplished by the free administration of saline solution intravenously and subcutaneously and fluids by rectum.

In our general surgical practice during the past three years we have been adhering to these rules very closely. With free use of saline and early enterostomy we believe that we have saved 65 per cent. of cases of severe ileus, that is, cases we feel sure would have terminated fatally had we not resorted to these measures. Our cases of ileus in almost all instances have been confined to the small intestines, and strange to say, have always followed operations performed in the lower abdomen. This we believe is due to the fact that in operations in the upper abdomen there is practically no disturbance of the small intestines and its mesentery.

In our work we usually make two practical divisions of ileus. These divisions are: aseptic or noninfectious and the infectious or ileus accompanied by peritonitis.

When ileus is complicated by peritonitis or *vice versa* if you will, peritonitis complicated by ileus, it is not so much the peritonitis that proves fatal; it is the ileus. Formerly we attributed the death in these cases as due to the septic peritonitis but now we know that if we overcome the ileus, if we subdue the distention and stop the regurgitant vomiting by ileostomy,

the patients will usually recover: with proper drainage of the peritoneal cavity they will in a large percentage of cases survive the peritonitis.

During the past year we have gone still further. We have anticipated postoperative ileus, and in the very severe cases have performed an ileostomy at the primary operation. The cases in which a "primary ileostomy" was done were appendix cases. These were all cases with marked distention, regurgitant vomiting and coprostasis, with anxious, pinched, drawn facial expressions and labored breathing; cases really *in extremis* in which we hoped against hope. Yet with the ileostomy, performed at the time of the removal of the appendix and the subsequent administration of saline, all three of these cases recovered. We feel sure that had we not performed the primary ileostomy in these cases, each would have proved fatal. Three cases is of course a small number to judge from, yet we felt so encouraged by the results of these cases that we intend in the future to continue the use of this measure as a life saver. We strongly recommend it to those who have not given it a trial. If at all possible these operations should be performed under local anæsthesia.

The subsequent closure of the ileostomy wound is simple. All that is necessary is to free the bowel from its parietal peritoneal attachment and after closing the opening with a simple suture of catgut and a Lembert suture of linen, it is dropped back into the peritoneal cavity. A small gauze drain is inserted down to the sutured gut and left there for forty-eight hours.

SUMMARY.

1. Death in ileus, so far as we can determine, is not due to toxæmia, that is, it is due neither to the absorption of bacteria nor their toxins nor to the absorption of some altered physiological secretion.

2. A depletion of the vascular and lymph systems causing a grave disturbance in the circulation, especially in the cerebral circulation, is a prime factor in the causation of death.

3. A pathologic change in the sympathetic nervous system, a loss of sympathetic control, is probably contributory.

4. Ileostomy at the primary operation should be resorted to in all the severe cases of peritonitis with overdistention of the abdomen. These operations should, when possible, be performed under local anæsthesia.

5. It is our opinion that many patients suffering from peritonitis and ileus die, not of the peritonitis, but of the ileus.

6. All treatment must be directed to the relief of the distention and to the refilling of the depleted vessels for which ileostomy and the free use of fluids are our sheet anchor.

INTESTINAL OBSTRUCTION RESULTING FROM A MALIGNANT TUMOR OF A RETAINED TESTIS ABDOMINIS.

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THE importance of examining the scrotum in tumors of the abdomen was brought to notice in my article in the *Practitioner*, April, 1912. Some time later to my writing that article I met with a case of intestinal obstruction in which the post-mortem examination revealed the presence of a malignant tumor of a retained testis abdominis. It is true that retained testicular tumors are rare and still rarer for them to give rise to the typical symptoms of intestinal obstruction, but it is also true that an overlooking of the scrotal examination leads in diagnosis to serious errors which can be easily avoided. The diagnosis of the condition might not save the patient's life, but we may surely avoid adding one more to our mortality register. That is my only plea for reporting the following case, which also illustrates how such retained testicular tumors may give rise to no serious symptoms until they attain enormous dimensions, when their removal by an operation is quite out of the question.

The patient was a Hindu, male, aged twenty-six years. He gave a history of constipation for 4 or 5 days previously. It was accompanied by severe pain in the abdomen and vomiting. The patient was a ryot and said that until the present illness he was in sound health and daily working in the fields. When he came into hospital he had a very anxious look and a typical acute abdominal facies. The abdomen was distended and its wall rigid and board-like. There was much tenderness on palpating the abdomen. The lower extremities were flexed to relax the anterior abdominal wall. The temperature was about 101° F. and the pulse quick and thready. The case was suspected to be one of intestinal obstruction. Laparotomy was done, when a huge inop-

erable tumor was seen inside the abdomen. The operation wound was closed and the patient sent to bed. He died a few hours later.

The post-mortem examination was conducted by Major H. Kirkpatrick, I.M.S. and myself. The absence of the testicle on the left side of the scrotum was noticed. A bluish cord occupied the left inguinal canal. Its extremity ended in the fascia of the thigh and could be traced up the abdomen in the direction of the spermatic veins. An enormous mass of growth about the size of a man's head occupied the hypogastrium. Its contents were partly fluid. The bladder was stretched up in front and a coil of the colon was attached to it above the pelvic aspect of the tumor. The ureters on each side were enormously dilated and lay on either side of the tumor. The kidneys were very hydronephrotic. Between them was found a mass of growth having the interior vena cava on its right side and the aorta behind. This secondary growth was friable in consistency, on section mottled and streaked with dark red and gray lines and not unlike an organizing thrombus. Its shape was roughly rounded and surface irregular. The primary tumor in the hypogastrium consisted of a semifibrous wall containing a softened semifluid mass of material which was highly hemorrhagic. It resembled a softened mass of brain substance. At the lower pole of the tumor and to its left side was situated a more solid mass. This was about the size of a large hen's egg and had a firm capsule but its substance was soft and friable. On section it was mottled with red and gray areas.

The other organs were normal. No secondary growths were seen in any of them.

A microscopical examination of sections taken from different parts of the tumor was conducted. The growth was mainly necrotic and showed extensive areas of hemorrhage. In the less degenerate portions the growth was seen to be composed of large, mostly rounded, cells with a fair amount of protoplasm containing a large circular nucleus, which showed active division in places. The cells were found scattered in a loose network of fibrous tissue which was very highly vascular, showing a large number of dilated vessels full of blood. The tumor was malignant and of a sarcomatous type. No remains of any testicular structure were seen in the sections made.

Evidently the symptoms of intestinal obstruction were due to the enormous size of the tumor, which, I am of opinion, had originated in a testis retained inside the abdomen.

This case differs from the one reported by me as " a chorion-epitheliomatous tumor of a retained testis abdominis " in the *Practitioner,* May, 1913, in that in the latter there were no symptoms of intestinal obstruction, the tumor being therefore clearly felt in the lower part of the abdomen, occupying the pelvis; the post-mortem examination revealed multiple metastatic growths and the tumor was structurally of a chorionepitheliomatous type.

I have to thank Major H. Kirkpatrick, I.M.S., for the permission given me to record this case of interest.

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OBSTRUCTIVE PELVIC LESIONS ASSOCIATED WITH CHRONIC DIVERTICULITIS.*

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THE attention of surgeons has been directed of recent years to diverticula of the intestine as a cause in certain previously very obscure chronic indurated conditions. Suspicions of tuberculosis or syphilis, but especially of carcinoma, have led to exploratory operation, the pathology being finally determined as that of chronic diverticulitis. Often after most difficult dissection drainage of a small abscess in the centre of a rigid induration has been the only treatment possible. Curative treatment has required excision or resection of the bowel, a matter of much technical difficulty at times. Among the last 800 intra-abdominal operations by the writer five cases of various forms of diverticulum have been encountered, some of minor consequence, others of much gravity. They were as follows:

CASE I.—*Meckel's Diverticulum.* Incidentally observed while operating for extra-uterine pregnancy. It was a cone-shaped offshoot of the lower ileum. As its opening was large and there was no danger of subsequent strangulation it was treated by inversion and suture. Probably it had not caused symptoms. Patient was delivered normally a year later.

CASE II.—*Meckel's Diverticulum.* Acute obstruction of ileum. Boy of twelve years. Subsequent to recovery from typhoid fever two attacks of partial obstruction in previous months had been spontaneously relieved. The existing attack had gradually developed into complete obstruction and paresis which caused death thirty-six hours after operation, which was done too late and under unfavorable conditions. A strong broad adhesion band had strapped down an inch or more of small intestine to the root of

* Read before the Philadelphia Academy of Surgery, December 1, 1913.

the mesentery at a point immediately below the origin of a Meckel's diverticulum. The latter was enormously swollen as was the nearby gut above. The diverticulum had apparently participated in the production of the obstruction due to kinking above the broad adhesion.

CASE III.—*Multiple Diverticula of Sigmoid Bowel.* Mrs. X., aged sixty, presented symptoms suggestive of pelvic carcinoma. In addition to benign uterine hyperplasia the lower sigmoid bowel was rigid and leathery. After resection the gut was shown to be pierced by numerous diverticula. Inflammation had extended from these to surrounding tissues (see ANNALS OF SURGERY, vol. lvi, p. 661).

CASE IV.—*Diverticulitis of Rectum.* Mrs. B., aged sixty-three, had suffered from pelvic inflammatory attacks, for years, and at times had been treated by various specialists, receiving the rest cure, etc. Operation showed broad ligaments, very small ovaries and tubes buried in very firmly organized old adhesions which also surrounded the rectum. While the entire rectum had not the rigidity and leather-like feel at times noted, there was a diverticulum readily accessible resembling a thick short epiploic appendage with a firm club-shaped head as large as a cherry. This contained a movable mass, continued pressure on which caused it to be extruded into the lumen of the rectum. The offshoot from the bowel then collapsed, showing it to be diverticulum. Deeply situated in the cellular tissue surrounding the rectum were several firm bean-sized indurations which probably represented other diverticula, though only the one was clearly demonstrable. Diverticulitis was doubtless the cause of old obscure pelvic symptoms.

CASE. V.—At intervals of several months during the past year I have operated for recurring intestinal obstruction under conditions which interested me greatly. The patient presented a most baffling and formidable combination of pelvic conditions, at first supposed to be carcinomatous but which were finally shown to be associated with one or more diverticula lying in an inextricable mass of indurated tissues and organs against the sacrum.

The extensive destruction and disarrangement of pelvic anatomy was remarkable. The patient, aged forty-three, short, muscular, fat, weighing 190 pounds, was admitted for an attack of intestinal obstruction which proved to be incomplete. Owing to distention little could be learned by examination above the pubis;

below the pelvis was found blocked by a large rounded fixed mass, apparently incorporating both uterus and rectum high up. There was a history of menorrhagia, and at long intervals slight discharge of mucus, so-called, but no blood from the rectum. There had been occasionally wire drawn stools for five years.

Operation was most unsatisfactory; an irregular, very hard pelvic mass inextricably incorporated the rectum and uterus with adherent coils of small bowel. After patient dissection nothing was accomplished except the release of a few adhesions, and in the apparent presence of malignancy the colon was attached to the left parietes, to be opened later when necessary. Strange to say, obstructive symptoms entirely disappeared following this operation, and large, well-formed stools were passed. All appearance of wire drawing disappeared, doubtless due to rectal drainage of a fluid sac and release of external pressure on the rectum. This relief continued for four months, the patient becoming apparently well. Wassermann test was negative and full doses of iodide of potassium used experimentally had no effect on the tumor. Then obstruction occurred gradually, became complete, and the colostomy was completed with immediate relief. Again she resumed the use of the rectum intermittently. The colon opening might be unnecessary for weeks, when it would again come into play. There was no valve action and no slack in the attachment of the colon. Six months later and nine months after the first operation, as the general condition seemed absolutely to negative the presence of carcinoma, I yielded to the solicitation of the patient to again try to remove the obstructive mass and make possible the closing of the colostomy. The attempt was again very disappointing and unsatisfactory. After the most difficult dissection a rounded pus sac with walls half an inch thick and very firm was traced behind the rectum, but it could not possibly be dissected out and had to be abandoned to drainage. Before opening it pressure did not cause it to drain into the rectum, though doubtless this occurred at times. The rectum where it emerged above the extremely hard mass was stiffened and the local vessels were deeply engorged. The microscope afterward showed no mucous membrane lining this pus sac, but it might have been destroyed by suppurative processes during years. I consider this sac to have been a diverticulum holding about three ounces of mucopus, and so surrounded except on the rectal side by absolutely rigid tissue that when full it produced obstruction by compression,

relieved spontaneously or otherwise at intervals. A second focus was isolated from very hard tissue and finally detached, almost by fracture. It was found to be lined with mucous membrane. Its site was closed in by celluloid thread. No determination could be made of the kind of intestine from which it sprang but from its situation it was supposed to be also a diverticulum from the large bowel. The laboratory examination by Dr. Pfeiffer showed it, however, to contain glands unquestionably from the small intestine. It was, therefore, a Meckel's diverticulum, lying deep in the pelvis and caught in the general mass. With the greatest difficulty could the uterus be found, well in front. Large cigarette drains were placed in the diverticular pus cavity and another at the suture site of the Meckel's diverticulum. There was a troublesome oozing of indefinite origin which set in after reaction and which contributed more or less to the death by exhaustion after three days. Gas was passed by the colostomy.

The occurrence of five diverticula in such a small group of abdominal operations as 800, while probably only a coincidence, would seem to indicate that the abnormality may be more frequent than is supposed. Detection of short diverticula is difficult and when buried in dense, inflammatory tissue may only be possible after resection of the intestine. Certain it is that the lesion has been often overlooked in the past, especially in the sigmoid and rectum.

Device for Temporary Gas-Tight Plugging of Colostomy During Operation on the Abdomen Elsewhere.—Owing to the recurrent attacks of obstruction and the uncertainty of being able to remove the cause, it was necessary to operate without permanently closing the colon in the last case cited. The opening was therefore plugged by a finger cot of heavy type, passed part way in, then loosely packed with gauze both within and without the fistula so as to make a retention button. The cot was then tied to a catheter and inflated with air. This made a perfectly gas-tight valve, not affected by fluids or gentle manipulation. I reported the use of the same device to the Academy of Surgery in 1909 (see ANNALS OF SURGERY, vol. li, p. 425), when it was applied to a vesicovaginal fistula. Before removing a bleeding kidney tumor it was necessary to prove the function of the other kidney, which was impossible with a bladder collapsed by the presence of the fistula.

The distended rubber cot, however, made a watertight joint and made the cystoscopy perfectly easy. Unless a little gauze is put inside the cot before inflation, the air may all go into one end of the device, which would then slip out.

ARTHROPLASTY.

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IT may be laid down as axiomatic that, where there are many cures for an evil or various remedies for a disease none is entirely satisfactory. Many standard operations, so to speak, are well nigh perfected, but a special method of operation for the relief of ankylosed joints has not been universally agreed upon. Failures as well as good results in such cases should be reported, as by such a course alone will we be able to reach a sound conclusion. Various methods have been used in attempting to mobilize ankylosed joints, and it is interesting to note the development of the operation.

In 1826, J. Rhea Barton[1] of this city performed an osteotomy for an angular true ankylosis of the hip-joint. He divided the bone through the great trochanter and a part of the neck of the femur; then prevented bony union by movements. In 1830, Rodgers[2] of New York modified Barton's operation by removing a disc of bone from between the trochanters, and in 1840, Carnochan[3] attempted to prevent bony union after he had accidentally fractured the maxilla while operating for ankylosis. He interposed a piece of wood between the bony surface. In 1860, Verneuil[4] interposed a piece of temporal muscle and fascia between the condyle and the glenoid in a case of ankylosis of the jaw. Twenty years ago, Helferich[5] performed a similar operation on a child one year old; and after resecting the condyle of the inferior maxilla inserted a flap from the temporal muscle between the articulating bones. Since that time, this operation has undergone various modifications. In 1895, Mikulicz[6] used practically Helferich's procedure but employed a flap from the masseter instead of from the temporal. In 1901, Cramer[7] operated upon ten cases of ankylosis of the patella by the interposition of a piece of vastus internus; of these ten cases six were successful. Orlow[8] in the same year attempted the use of metal plates and gold foil as the intermediate body and this procedure was followed by the use of other non-absorbable materials such as plates of celluloid, zinc, silver, cambric, collodion and rubber.

With these agents an occasional good result was obtained, but in the great majority of cases a few months after operation

the foreign material was extruded from the joint and ankylosis returned.

In 1907, Weglowski[9] transplanted with success the cartilage of a rib in a case of ankylosis of the elbow. Chulmsky,[10] in 1902, tried to use decalcified bone, magnesium and ivory but they all became absorbed and ankylosis returned. He deduced, however, that as false joints or pseudarthroses in ununited fracture of long bones were formed of aponeurosis and fatty tissue, the same tissues could be used in the formation of a new joint in a case of ankylosis. In the same year Nélaton[11] operated upon two cases of ankylosis of the hip-joint by interposing a strip of fascia lata between the head of the femur and the acetabulum. In 1905, Murphy[12] reported twelve cases in which he interposed fascia and muscle covered with a layer of adipose tissue to produce, to quote him, "Normal movable joints with capsules and collagen intra-articular fluid." By this method hygroma-bursa formation is sought. The formation of hygroma being "the result of a degenerative or absorptive process in fatty tissues with hyperplasia of the connective tissue element, the segmentation of the collagen into solution, 'fibrinoid', a liquefaction of hypertrophied connective tissue." His first operation of this character was performed in 1901. In 1909, Baer[13] made a preliminary report on the use of animal membrane in securing mobility in ankylosed joints. He used pig's bladder "which is chromicized so as to remain intact about forty days." The pig's bladder is boiled in cumol. Osgood has reported several successful cases operated upon by this method. Baer also used Cargile membrane or the peritoneum of an ox, as the interposing agent but found that it was absorbed in a period of ten to fifteen days and therefore not useful. This method of using animal membrane had been attempted before by Foderl, who, in experimenting on animals, interposed between the bones pieces of bladder and also the wall of ovarian cysts.

This is but a partial list of those who have contributed to the development of the operation.

When should operation be performed in a case of ankylosis?

For practical purposes ankyloses may be divided into two main divisions: the false, periarticular or extra-articular, and the true, articular or intra-articular. Murphy sub-divides the periarticular into capsular and extracapsular; and the articular into synovial, fibrous, cartilaginous and osseous.

The main treatment should, of course, be preventive, that is, one should attempt to guard against ankylosis of a joint which has been the site of an infectious or traumatic arthritis. There are exceptions, however, even to this rule, as in tubercu-

lous affections of joints ankylosis is often most desirable. In such cases or in cases where ankylosis is inevitable the aim should be to obtain a position which will render the part most useful. Baking, massage, passive movements, brisement forcé with an anæsthetic, tenotomy, myotomy, tendoplasty or myoplasty, excision of tendon sheaths, or cicatrices, are all methods employed in relief of periarticular, extra-articular, or false ankylosis.

Should some form of open operation be attempted in intra-articular ankylosis? This naturally must depend upon the cause of the ankylosis, the joint affected and the present usefulness of the part. One hesitates to open a joint which has been the site of a tuberculous infection, because, although the infection may apparently be dormant, operation and the subsequent passive movements may cause the infection to take on renewed activity. Many such cases have, however, been successfully operated upon, among which is the case to be shown to-night. The X-ray is of course valuable, but not absolutely final, in showing if the infection is still active. Hesitancy is unnecessary if the ankylosis is due to trauma such as fracture or to infections such as rheumatism, gonorrhœa, etc.

The mandibular joint offers the best field for operation. First, because of the favorable prognosis, second, because of the immense importance to the individual of mobility in this joint. Fortunately ankylosis of this joint, which follows severe forms of stomatitis and noma, is usually extra-articular and mobility can be usually obtained by relieving the periarticular cicatrices. When ankylosis is intra-articular arthroplasty can be performed and either a flap from the temporal or masseter muscle or chromic pig's bladder can be used for the formation of a new joint. The latter has been successfully used by Brackett.[14]

From the reports of cases in literature it would seem that the future use of these interposing tissues may depend upon the joint involved. It would seem possible that the Murphy operation will continue to be used in the knee-joint and in the hip-joint. In these joints, which are joints of locomotion, and

which carry the weight of the body, hygroma formation is necessary or at least desirable and Murphy's operation leads to a hygroma or formation of a new bursa. On the other hand, in the elbow, shoulder and the mandible a wide range of mobility is desired; there is no weight born by the joint and it would therefore seem that the formation of hygroma is not essential; therefore, the use of Baer's membrane is the preferable material for interposition. The technic of the interposition of this membrane is considerably easier than the technic of the Murphy operation.

In the hip-joint any position of ankylosis must be not only an inconvenience but an actual interference with one's ability to earn a livelihood. It should, therefore, offer a good field for arthroplasty. The same may be said of ankylosis of the shoulder.

In ankylosis of the knee and elbow, however, it would seem in the light of our present knowledge and experience that one should not too hastily fly to operation.

Even according to Murphy's own statistics the elbow and the knee offer the poorest prognosis of any joints. Therefore, if a patient has intra-articular ankylosis of a knee-joint, the ankylosis being with the leg in extension, there being no pain and the man or woman being able to perform his or her occupation, it would not seem that arthroplasty should be attempted without a full explanation to the patient of the facts that the operation will be followed by considerable pain, and that, whereas some motion may be obtained, it may be slight and ankylosis may recur.

The same might be said of the elbow. If there is ankylosis of elbow with the forearm at right angles to the arm, and if, in spite of the ankylosis the patient is able to earn a livelihood and the extremity is not painful the pros and cons should be carefully weighed before deciding on operation.

On the other hand, given a knee ankylosed at or near a right angle, or an elbow ankylosed in extension, positions which must of necessity be a great handicap, then it would seem that operation is entirely justifiable. Preferably arthroplasty should be

attempted, for, even if unsuccessful as to mobility, a better position can be obtained for possible subsequent ankylosis.

Illustrative Case.—A boy, now thirteen years old, was admitted to the Orthopædic Hospital on October 11, 1912, in the service of Dr. William J. Taylor. The history was that of a tubercular arthritis of the right knee. Several operations had been performed merely for draining the joint. The condition of the knee was that of ankylosis of tibia, fibula and patella. The knee-joint was ankylosed at an angle of 45 degrees. There was no pain; no inflammation; no fever; all sinuses were healed.

Operation was performed by Dr. Taylor, November 8, 1912. A U-shaped flap was made with convexity downward. The skin flap was turned upward. The patella was sawn obliquely from above downward, and the joint was opened. All adhesions between the tibia and femur were freely liberated, the surface of the tibia and surfaces of the condyles cleaned of fibrous tissue and the capsule was cut away. By means of curved and straight chisels new and fresh surfaces were made. Sufficient bone must be chiselled away to allow for the interposing flaps and yet too much bone must not be removed for fear of obtaining a movable but weak joint.

Murphy has pointed out the necessity of keeping the intercondyloid ridge on the tibia intact to prevent lateral slipping of the femur.

The two interposing flaps were then cut; one from the external side, the other from the internal. They were interposed between the bones and sutured with No. 3 chromic gut. Because of the inability to get a good surface on the under aspect of the patella, it was turned over so that the normal anterior aspect became the posterior aspect. The wound was closed without drainage and the limb placed in a plaster case. This case was not removed for four weeks and no passive nor active movements were made until that time.

He was discharged from the hospital ten weeks after admission. He wore a supporting brace steadily for 6 months, then intermittently until end of a year.

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FIG. 1.

Result of arthroplasty on an ankylosed knee-joint. Flexion after operation.

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PARALYTIC TOE-DROP. PUTTI'S OPERATION FOR ITS RELIEF.*

WITH REPORT OF A CASE AND SLIGHT MODIFICATION OF THE TECHNIC.

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In a survey of the deforming results of anterior poliomyelitis so far as the various joints are concerned, probably the most difficult of mechanical control is the hip-joint and next to it may be placed the ankle-joint, because of the range of movements of the foot when deprived of muscle control. Whether the loss of power be confined to the anterior group of muscles, or to the posterior group, or to both, the resulting deformity presents in many instances, a problem difficult of solution either mechanically or surgically. The multiplicity of forms of braces and the varieties of operations employed from time to time are the best evidence of the inefficiency of any one, and the constant effort of orthopædic surgeons has been to devise a means of correction which should prove reliable and permanent.

It must not for a moment be considered that every case of toe-drop or of calcaneus or of flail-foot following an attack of infantile paralysis is a proper one for operation, for it is not. Many paralyzed muscles recover power years after the attack, when the strain of position or function is removed from them, and the earliest and most essential factor in the treatment of these cases of paralysis is to put the parts at rest and remove strain from the weakened and inert muscles. This will favor the subsidence of inflammation in the motor cells of the cord, will check or lessen degeneration in these cells, will prevent the onset of deformity and the stretching of structures, and will also frequently be followed by return of power in muscles thought to be dead. After about six years have passed, how-

* Read before the Philadelphia Academy of Surgery, December 1, 1913.

ever, with careful supervision as to muscle strain, with massage and other local means to aid restoration of function, if paralysis still persists in a muscle or group of muscles, it is quite proper to consider this the real, permanent or residual paralysis and to institute surgical measures which will preserve the normal balance of the part for the performance of its functions in the best possible manner. Without such means, the patient is doomed to a life of brace-wearing which is always troublesome and at times extremely disabling through breaking of the appliance and inability to have prompt repairs made.

The surgical correction of paralytic conditions of the foot may conveniently be considered under four divisions: (1) Operations upon the bony parts; (2) operations upon the tendons and muscles; (3) operations upon the skin; and (4) operation by silk inserts in tendons or ligaments.

Under the first group is included arthrodesis of the ankle, transtarsal or tarsal joints. These operations have proven only partially successful. Great difficulty is experienced at times in securing firm ankylosis and where this does obtain, the part ofttimes proves painful for walking and the gait is a stilted one.

The second group received earliest consideration through the work of Nicoladoni, who in 1881 first practised transplantation of live tendons to assist or replace the paralyzed ones, and this was the first really great impetus to the surgery of paralysis. Many varied types of operation have been suggested and performed on these structures since then, such as shortening by tucking, by cutting out a section, by changing the point of insertion and by changing the angle of pull, by passing the tendon through a subperiosteal groove and fixing it there (Dr. W. E. Gallie, Toronto, Can., ANNALS OF SURG., March, 1913, and *Amer. Jour. Orth. Surg.*, July, 1913). In all of these methods, the immediate results are good but in all excepting where the tendon of a live muscle is transplanted and where it is fixed in a subperiosteal groove, the deformity is extremely likely to recur, because the structures which stretch, viz.: the degenerated and paralyzed muscles, are still subjected to strain. Where they are eliminated as in the procedure reported by

Gallie, the results are sure and certain, as the tendons are converted into ligaments and do not stretch.

In the third group, Robert Jones has had good results from the resection of a portion of skin and fascia on the elongated side and bringing the edges together to maintain correction. This procedure when used in conjunction with tendon work affords reinforcement and lessens strain.

The fourth group has been extensively employed and is to be very strongly recommended. The results of the inserts of paraffined silk appear to be permanent, whether the parts reinforced be tendon or ligament. The only criticism to be offered against it is that silk is a foreign body, and if the same results can be secured by the use of living structures which are already in position and which are unyielding, I believe the local tissues should be utilized even though it is urged that the silk inserts rarely cause trouble by suppuration or otherwise.

In August, 1913, Dr. V. Putti, of the University of Bologna, Italy, performed for the writer another method of fixing these permanently paralyzed tendons which he has been using for some time with excellent results. The underlying principle is the same as that used by Sangiorgi (quoted by Gallie) and Gallie, viz.: to convert the tendons of the paralyzed muscles into ligaments, but Putti eliminates absolutely the degenerated muscle tissues which are the structures that stretch and permit the recurrence of the deformity and in this respect renders results more certain.

The operation for toe-drop with paralysis of the tibialis anticus, dorsal flexors of the toes and the peroneus tertius as done by Putti is as follows:

The tendo achillis is first made long enough (if not already so) to allow a right-angled position of the foot. An incision four or five inches long is then made from above the ankle-joint upward along the tibial crest and the anterior tendons exposed. These are separated and all are severed from their muscle attachments as high up as possible. The tibia is then freed about the middle of this incision and an oblong hole of sufficient size to receive all the tendon ends is mortised through it. The periosteum is next lifted from the front surface to the tibia. A tendon end is passed through the hole from one side and drawn taut, the foot being held at a right angle. Another tendon is next passed through from the other side

and the remaining tendons alternately until all are threaded. The ends are next drawn under the raised periosteum and firmly stitched in place to tendons, periosteum and tendon ends (Putti uses silk-worm gut sutures for this and leaves them buried) and the wound is closed. The parts are fixed for a couple of weeks by a splint; but Putti expresses himself as favorable to treatment without any support, believing that union will be much more firm if a little strain is permitted on the operated tendons and that we weaken the attachments by long continued fixation.

The mechanical features of the operation are entirely correct in the elimination of the weak and easily stretched muscle structures and conversion of the tendons (which stretch but little when continuous) into a large strong ligament having a sufficiently long hold on the foot and leg to give firm fixation and withstand quite a degree of strain. On November 21, 1913, I operated by this method upon a boy, S. M. (patient shown to the Academy), aged thirteen years, who had an attack of infantile paralysis over eleven years ago. There was complete loss of all the anterior muscles of the leg and foot with slight power in the plantar flexors of the toes and in the tendo achillis. There is also good power in the hamstrings, very slight power in the rectus femoris, and flexion of the knee to 15°.

After fixing the proximal ends of the severed tendons, as above described, the foot was maintained perfectly in the right-angled position and a plaster splint was applied to the entire leg, the knee being first forcibly straightened preparatory to a transplantation of the external hamstring into the patella.

In one feature, however, the operation impressed me as lacking and I shall correct this at the subsequent operation on this case. When the dorsal flexors are drawn taut, the toes stand out straight and would probably remain so if the plantar flexors were also paralyzed, but with these muscles alive and in action during function of the foot, it will be but a short while until the toes will become flexed through dropping downward of the metatarsophalangeal joints (from stretching of the fibres holding the dorsal flexor tendons to the top of the metatarsals and proximal phalanges), and the flexion of the distal phalanges of the toes and a condition of hammer-toe will be established

with dorsal dislocation of the toes upon the metatarsal ends. To obviate this, I propose to engraft the tendons of the dorsal flexors into the distal end of the metatarsals, either by severing them well forward and drawing the end through a hole drilled in that part of the metatarsal, or by lifting a flap of periosteum and cutting a groove on the dorsal surface of the bone, laying the tendon in this groove and securing it by suturing the periosteal flap over and to it (as described by Gallie and Sangiorgi).[1] A bone-flap could also be used if desired, but I believe one of the others will be sufficient to focus the ligamentous pull on the distal end of the metatarsals and obviate the threatening deformity of the toes.

This procedure is simply a combination of two mentioned operations but it will, I believe, provide the solution of the treatment of this most troublesome condition. Putti's method of fixing the tendons in the bones of the leg is safe and sure and of course can be applied to any type of paralytic deformity about the foot, such as calcaneus (using the tendo achillis and plantar flexors of the toes or the tibialis posticus or the peronei), valgus (using the tibialis anticus or posticus or both), or varus (using any or all of the peronei).

[1] This operation was completed as above outlined on December 12, 1913, with very satisfactory immediate results and there is every reason to feel that the ultimate results will be as desired as this additional work has been thoroughly tried out by many operators and has received the stamp of approval.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held December 1, 1913.

DR. GWILYM G. DAVIS, the President, in the Chair.

ARTHROPLASTY OF THE KNEE-JOINT.

DR. HUBLEY R. OWEN presented a paper on Arthroplasty of the Knee-Joint, for which see page 426. An illustrative case was also presented.

DR. WILLIAM J. TAYLOR said that in this case there had been suppuration, the patella was worm-eaten on the under surface, and fixed to the articulating surface of the femur, so that in order to get movement it was necessary to turn it upside-down. Flaps of fascia and fat were made, taking them from above, bringing them down between the articulating surfaces, and as they were not quite long enough to go clear through they were lapped over about one-third and stitched. The boy has a better joint than had been hoped for. The patella was sawed through obliquely in order to get the largest possible surface, and each half turned upside-down, the sawn surfaces twisted in the opposite direction, then brought together again and united by catgut sutures. This made a perfectly good, strong, bony union, with the result that the patella is now perfectly movable.

In this case the condition of the bone was such and the angle was such that it was necessary to take off quite a considerable amount of bone, particularly from the end of the femur, to get the leg straight. It is essential to take off enough of the surfaces to make the apposition between the ends of the two bones comparatively easy.

As to the question of the other joints, some years ago he had a man under his care in whom both elbows were absolutely stiff, due to an infection from his tonsils. He resected his left elbow

and gave him a perfectly useful and serviceable arm, so much so that he declined to have the other one operated upon, saying that he could get along with the one. Dr. Taylor had resected the shoulder-joint many times and the results are so satisfactory that this is the operation of choice, rather than arthroplasty.

Dr. J. T. Rugh called attention to the method of arthroplasty originated by Dr. R. T. Taylor, of Baltimore, which consists in the shaping of the joint surfaces by the removal of a sufficient amount of bony material to allow free function, and then filling the joint cavity with a preparation of wax which has a rather high melting-point. The joint is then closed and movements are begun at the end of a week or ten days. He had seen some remarkable results in these cases from that procedure. It is comparatively easy of performance, the most difficult part being the removal of the joint surfaces.

Dr. Astley P. C. Ashhurst said that it seemed to him that a more important matter than the mere question of technic is the indication for the operation. He regretted very much that Dr. Owen cannot say whether or not this was really a tuberculous case. If he has made a tuberculous knee-joint movable with safety he would be accomplishing a great surgical feat. Dr. Ashhurst was one of those who believe arthroplasty to be contra-indicated in cases of tuberculous ankylosis. It is interesting to recall that Dr. John B. Murphy attempted arthroplasty on an ankylosed hip that was undoubtedly tuberculous, found an unsuspected abscess, and left the man, at last reports, with discharging sinuses.

Dr. Owen spoke with proper caution about the indications for arthroplasty, and though the patient he shows has a good motion (120 to 150 degrees), it would seem that in a child of twelve years supposed to have a tuberculous ankylosis in bad position, it would have been safer on general principles to have taken out a wedge of bone and thus made the knee-joint stiff and straight.

Dr. Gwilym G. Davis thought that in spite of the successful result in this case the introduction of drainage is decidedly of service as a precautionary measure. On two or three occasions he had not used drainage and had always regretted it; by this he meant drainage for 24 to 48 hours.

Apropos of the tuberculosis question, he operated once on a tuberculous knee, and while he got some motion he did not get as much as he desired and the knee remained painful for a long, long time, and he had been inclined to be conservative since then.

In relation to the elbow-joint it is one of the most satisfactory joints for arthroplasty as well as for resection, and the results from arthroplasty are so far more brilliant than are obtained by resection.

PARALYTIC TOE-DROP.

DR. J. TORRANCE RUGH read a paper on Putti's Operation for Paralytic Toe-Drop, for which see page 432.

DR. A. B. GILL (by invitation) said that he had observed four cases in which silk ligaments have been implanted to correct paralytic foot-drop. The ligaments are put through a hole drilled through the tarsus and then passed up the leg within the sheaths of the peroneus tertius and the tibialis anticus, and then passed through a hole drilled through the crest of the tibia and fastened there. Of the four cases, one is now of two years' standing, in which the silk is still holding the foot in good position with marked improvement in the gait. One silk ligament of the four broke, owing to weakening of the silk by too prolonged boiling in the bichloride of mercury. It was an easy matter to replace the silk. The other cases are in good condition. There has been no condition of flexion of the toes resulting from the operation. It will be interesting to observe in the Putti operation when the tendon is severed above and below whether there will occur degeneration and stretching of the tendon.

DR. GEORGE ERETY SHOEMAKER expressed surprise at the use of buried silkworm gut sutures. This is a substance which was tried out very thoroughly years ago in this country and abandoned as a buried suture material, because it was absolutely unattacked by the cells of the body and always remained as a foreign body during the lifetime of the patient. A permanent suture does no more good than a temporary one, as under the slightest tension it cuts until it does no more holding. He had had occasion to take out a considerable number of silkworm gut sutures put in under perfectly sterile conditions, the sterility persisting for say two years, when the sutures would begin slowly to work their way out. He had buried many hundred worm gut sutures in aponeurotic tissue, and had seen probably one per cent. give trouble after long intervals.

DR. J. TORRANCE RUGH (in closing) said that he had mentioned the fact that Professor Putti used the silkworm gut, though he himself did not. He called his attention to its abandonment

in America and he said he never had any trouble whatsoever from it. He had used it for a number of years and he claimed most excellent results. Dr. Rugh used chromicized catgut in this case as he does in all.

In regard to the silk ligaments, he was a firm believer in their use, but anything of that kind is a foreign substance, and if you have structures which are capable of preserving the position of the foot, why introduce a foreign substance? He had done quite a number of these cases of silk ligaments for this condition of toe-drop, for valgus and for varus and had had no trouble since using the paraffin silk, but he did have trouble with bichloride silk, as it came out by sterile suppuration. The paraffin silk remains in and is very good. But here are structures which are inelastic, and already in place and if you fix them you make ligaments out of the tendons. If any change takes place, even if they lose their identity as tendons, they are still ligaments.

This operation has been done for a couple of years by Putti, who claims that they were holding splendidly, and unless the tendons should stretch, it is the ideal operation for this condition.

RADICAL CURE OF AN INCARCERATED INGUINAL HERNIA IN AN INFANT TWENTY DAYS OLD.

Dr. Walter E. Lee reported the history of an infant who was admitted, January 20, 1912, to the service of Dr. James P. Hutchinson at the Children's Hospital.

It was by the courtesy of Dr. Hutchinson that the reporter operated upon the child and had the privilege of reporting the case.

Upon admission the right half of the scrotum was found enlarged and tense and the tumor emerged from the external inguinal ring. The scrotum became normal in size after taxis when a gauze pad over the external ring with adhesive plaster and spica bandage reinforcements were applied to secure the reduction. Following this the child had three normal bowel movements and seemed perfectly comfortable for twenty-four hours when the tumor reappeared and operation was decided upon.

The skin and subcutaneous tissues were anæsthetized by infiltration with thirty minims of a four per cent. solution of eucaine. On opening the sack about one drachm of bloody fluid escaped. One large loop of small intestine, ten inches in length, with its mesentery were found in the sack and the mesentery was twisted

upon itself one complete turn. The bowel was very dark in color but the peritoneal coat lustrous, and after irrigating with hot normal salt solution, the color of the bowel improved and the circulation returned in the mesenteric vessels. The constriction was found at the internal ring and after dividing it the bowel was returned to the abdominal cavity. The aponeurosis of the external oblique and the internal oblique muscle were then sutured to Poupart's ligament with chromicized catgut, thus depressing the cord. The skin wound was closed with three silkworm gut sutures. At the close of the operation the infant vomited fecal matter and this was the first vomiting of which we had any knowledge.

The child nursed the following morning and this day there was a normal bowel movement. The convalescence was uneventful and the child was discharged with a firm wound on the twenty-first day.

Dr. Lee called attention to the satisfactory anæsthesia obtained by the local infiltration of a solution of eucaine. The anæsthesia seemed perfect during the entire operation, the infant busily sucking the thumb of the nurse.

RADICAL OPERATION FOR A HERNIA OF THE UMBILICAL CORD IN A NEW BORN INFANT.

Dr. Walter E. Lee reported the history of an infant who was brought to the dispensary of the Children's Hospital one hour after its birth. Dr. Edward B. Hodge saw the child and advised immediate operation. It was by his courtesy that the reporter operated and had the privilege of reporting the case.

The infant seemed perfectly formed except for a large cystic tumor which protruded from the anterior abdominal wall. The tumor was nearly as large as the infant's body. The circular opening in the abdominal wall, an enlarged umbilical ring, extended from the xiphoid cartilage to within one inch of the pubic bone. The skin of the abdomen was continued upon the pedicle of the sack for one-quarter of an inch, where it ended as a sharp border beyond which a transparent membrane as thin as paper covered the remaining portion of the tumor as far as its distal extremity, where the covering was drawn out like a funnel and became continuous with the ligated umbilical cord. The umbilical vessels could be felt as a cord on the lower surface of the tumor. The liver, the spleen and the large and small bowel could be clearly seen through the hernial covering floating in a clear transparent

fluid. These organs were all outside of the margin of the umbilical ring.

The child was anæsthetized with ether and an attempt made to reduce the organs. This was unsuccessful and upon opening the sack, the bowel, liver and spleen were found adherent to the sack wall in many places. After ligating the umbilical vessels and breaking the adhesions the bowel and spleen were reduced, but it was necessary to enlarge the opening in the abdominal wall by an incision toward the pubes before it could be replaced. The hernial sack was excised and the abdominal wall united with ten chromicized catgut sutures which passed through the entire thickness of the wall. The tension upon these sutures was relieved with strips of Z. O. adhesive encircling the abdomen. The increased intra-abdominal pressure resulted in a large amount of meconium being expelled at the end of the operation. The child lived for five days. During this time the bowel moved three to four times daily and it regurgitated small amounts of mucus flecked with black particles which looked like meconium. It was fed with a weak mixture of condensed milk and an attempt was made to bring some of the mother's milk to the hospital on the fourth day but the plans miscarried.

No autopsy was obtained and the cause of death remains uncertain.

Dr. Lee added that congenital herniæ of the umbilical cord should be classified as malformations since the peritoneum and viscera are not abnormally protruded but lie in front of the anterior abdominal wall as in the early stage of intra-uterine life, the normal closure failing to take place. It is really an ectopia.

The outer covering of the sack is formed by the distended tissues of the umbilical cord, a thin layer of the jelly of Wharton, and behind this is the hernial sack, corresponding in its position to the peritoneum and continuous with the abdominal peritoneum.

As the circulation in the umbilical cord ceases immediately after birth the stump of the cord becomes necrotic, shrinks up and is cast off after several days; the covering of the hernia of an umbilical cord naturally undergoes the same fate, exposing the abdominal viscera, the consequent suppurative peritonitis usually causing death.

Radical operation was first advocated by Lindfors in 1881. Hansson published a collection of 73 cases treated in the antiseptic method, 1900. Mortality of 32.8 per cent.

DESTRUCTIVE PELVIC LESIONS ASSOCIATED WITH CHRONIC DIVERTICULITIS.

DR. GEORGE ERETY SHOEMAKER read a paper with the above title, for which see page 422.

THROMBO-ANGIITIS OBLITERANS (BUERGER'S DISEASE).

DR. PENN G. SKILLERN, JR., said that thrombo-angiitis obliterans of the lower extremity is the designation proposed by Buerger (*Am. J. M. Sci.*, 1908, N. S. cxxxvi, 567) for the condition formerly known as "endarteritis obliterans," "arteriosclerotic gangrene" and "Spontan-gangræn" of the Germans, and is based upon conclusions drawn from pathological studies of the vessels obtained from nineteen amputated limbs. In brief, we are dealing with a thrombotic process in the arteries and the veins, followed by organization, and not with an obliterating endarteritis. Most of the larger arteries and veins of the amputated limbs were found obliterated over a large extent of their course. The veins share equally with the arteries in the lesion of occlusion, and may even be more extensively involved. The distal parts of the vessels, rather than the proximal, are closed. At times, 2 to 4 inches of a vessel's length is closed, while the portions above and below are apparently normal. There is often an involvement of some of the smaller branches, such as the tarsal and the metatarsal, but the smallest arteries are free. The process involves the intima, the media, the adventitia, and the perivascular tissues. The periarteritis is a fibrous agglutinative process that binds together the artery and its collateral veins, and sometimes also the accompanying nerve, so that the liberation of the individual vessels by dissection is difficult. The cause is probably partly static and partly toxic.

The disease usually attacks Polish and Russian Jews between the ages of twenty and thirty-five or forty years, so that the names juvenile and presenile gangrene have been employed. After longer or shorter periods, characterized by pain, coldness of the feet, ischæmia, intermittent claudication, and erythromelalgic symptoms, evidences of trophic disturbances appear which finally pass over into a condition of dry gangrene. The left leg is usually the first to become affected, and when simultaneously bilateral the diagnosis of Raynaud's disease is often made. In the pendent position a bright red blush comes on the toes and foot. Soon a blister, hemorrhagic bleb, or ulcer develops near the tip of one

of the toes, usually the big toe, and frequently under the nail, and when this condition ensues the local pain becomes intense. Even before the gangrene, at the ulcerative stage, amputation may become imperative because of the intensity of the pain.

The following case illustrates with great fidelity most of the features described by Buerger.

M. L., male, Hebrew, aged forty-two, sheet-metal worker, presented at the Surgical Out-patient Department of the University Hospital, service of Dr. B. A. Thomas, July 17, 1913, complaining of intense pains in both legs of a year's duration. The pain in the left leg is greater, and is constant, night and day. It is chiefly burning in character.

Examination revealed both feet involved in ischæmia, obliteration of pulse or dorsalis pedis on both sides, and a dusky blush involving both great toes. A trophic ulcer beneath the nail of the left great toe exposes the end of the ungual phalanx.

Nerve-stretching had been performed in another city without relief, and everywhere the patient went amputation was advised as the only method of relief from the wearing pain. Examination of the distribution of the pain showed that it was confined chiefly to the area presided over by the cutaneous filaments of the musculocutaneous nerve. It was figured out that if this nerve were resected, amputation could be postponed indefinitely, and the patient allowed to retain the otherwise useful limb—at least until extensive development of gangrene indicated amputation. Accordingly, using a solution of novocaine two per cent., with adrenalin 1 to 3000, intradermic infiltration along a transverse line 2 inches broad with centre over antero-external border of fibula, was made 4 inches above the base of the fibular malleolus. The cutaneous division of the musculocutaneous nerve was exposed at its emergence from the deep fascia, and a section one inch long was excised. The relief from the burning pain was ***immediate***. The wound was drained by a folded strand of silkworm gut. It was closed by 4 silkworm gut sutures, and a dilute alcohol dressing applied.

The day after operation there was no pain in the foot. Reports upon the blood and the urine, which had been previously collected, showed that the Wassermann reaction was negative and that there was no sugar. The patient was given 5 drops of a saturated solution of the iodide of soda and one one-hundredth of a grain of nitroglycerin three times a day after meals.

Owing to the impoverished circulation of the limb, the operative wound remained indolent for several weeks, but was eventually stimulated to heal by the application of Bier's powder of nitrate of silver and powdered clay.

A month after operation the patient complained of pain in the distribution of the anterior tibial nerve to the adjacent sides of the great and of the second toes. This nerve was reached in the first interosseous space by a hypodermic needle, and was blocked with alcohol. This sufficed to relieve the pain.

DR. MORRIS BOOTH MILLER said that he had had some experience with Buerger's disease and had been very much interested in Dr. Skillern's account of the relief of pain by the severance of the musculocutaneous nerve. These cases are most distressing, the patients suffering at all times, especially during cold weather. He was surprised at so much benefit having resulted from cutting a single nerve; his observations would have made him believe that the severance of the whole nerve trunk would be necessary. Within the last ten days he had seen another complication which may occur, a man upon whom he had operated at different periods for Buerger's disease was stricken with a cerebral embolus. The diseased condition is one of vascular change involving all parts of the blood-vessels, both arteries and veins, and of the structures outside of the vessels, thereby affecting the nerves. This process is not a continuous one; it seems to show periods of rest, when the patient will be nearly free from pain though showing distinct objective symptoms, and then there will be an increase of all symptoms corresponding to new and further vascular change. In the case mentioned of cerebral embolus the man had just suffered an augmentation of this phenomenon.

DR. DUNCAN L. DESPARD said that he had had an opportunity of operating on a number of these cases and then following them by microscopic examination of the vessels. In regard to the cause of the condition he had been struck by the proliferation in the intima and the elastic tissue which takes place in these vessels and frequently without obliteration of the lumen of the artery. He did not think that the obliteration by a thrombus is entirely to be accepted as the cause. He had a case last summer, of a man who suffered greatly. Since June applications of X-rays, two or three times a week, had been made. As a result he has obtained a great deal of relief from his pain. It has passed entirely from his toes and legs and he now complains of pain in the region of the

knees, which have not been subjected to the X-rays. Strange to say, the temperature of the legs has increased. They were cold during the summer and the other day there was a perceptible increase in the local temperature to the hand. Whether he will have continued relief or that this is simply a temporary improvement, remains to be seen.

Dr. George P. Müller said that he had seen a great many of these cases, mostly in Dr. Frazier's Clinic in the University Hospital. A number of years ago the affection seemed to be limited to the great toe, and was commonly known as Mitchell's disease, but in recent years they have observed more cases in which the entire foot or even the leg was involved. He did not know that they had obtained any permanent relief by any method of treatment short of amputation. They have stretched, injected, and cut the internal saphenous or external cutaneous nerves, and have had X-ray treatment used, and high frequency current, etc. In two cases he performed arteriovenous anastomosis and in another he tried to do so but found the femoral artery a solid cord. He was not an advocate of this method of treatment and cannot agree with the enthusiastic claims of Wieting, Bernheim, and others. They have resorted in at least two cases to amputation. These amputated limbs were examined in Dr. Speese's Laboratory and there was distinct evidence of thickening of the femoral vessels and more or less thrombosis in the veins.

Dr. Nathaniel Ginsburg (by invitation) said that for some time he had been interested in this subject, because of the almost sole limitation of this affection to a single race—the Jews.

Continued observation of young Russians, who have recently come to this country, with the idea of determining whether it is a purely peripheral condition, has convinced him that this disease possesses a symptom complex of which the peripheral state is only a part. As an example, he has been observing now for the past five years a young man of about twenty-four years of age, who presents marked disturbance of the circulation in his hands and feet. Examination of his surface blood-vessels reveals very feeble pulsation in his brachials, axillary and femoral arteries, indicating a general vasomotor constriction of all these blood-vessels. The maximum effect is first felt in the digits of both upper and lower extremities, which become the seat of trophic changes, very often necessitating amputation of the part. While Buerger has established the pathology of this condition as far as the peripheral ves-

sels are concerned, possibly Dr. Mitchell was correct, when many years ago he suggested the spinal cord as primarily the seat of the trouble, since theoretically stimulation of the sympathetic motor neurons of the cord will produce marked peripheral vasomotor constriction of the blood-vessels.

The relationship of this condition largely confined to a single class of people may be explained upon the basis which Dr. Crile has enunciated in his theories underlying the production of shock. This disease is found in a highly emotional class, subject to tachycardia, and neuroses of every description, and who suffer postoperative shock to a greater degree than any other class of patients. They are more subject to sensory stimulus, and therefore react to a greater corresponding degree; hence the great variations in blood-pressures observed in the same patients at different times. It would seem that an important predisposing factor in the production of this condition is something in the physiological make-up of these patients, not any previous article of diet, but perhaps an unusual sensitiveness of their cerebral or spinal motor neurons acting upon the blood-vessel wall.

Dr. Penn G. Skillern (in closing) said that in regard to the entire relief from pain in this case it might be explained by the pain being confined to the distribution of the cutaneous division of the musculocutaneous nerve. The process described by Buerger involves the intima, the media, and the adventitia together with the perivascular tissues, one huge cicatricial mass from the lumen out to the muscles. The veins are equally involved and that is why any attempt at arteriovenous anastomosis fails. This condition is not to be confused with Raynaud's disease, which is a *functional* disturbance. The kinetic theory of Crile, suggested by Dr. Ginsburg, does not explain in any way this cicatricial mass of blood-vessels. The cause is most likely a toxæmia somewhere in the body, and the predilection of the disease for the vessels of the lower extremity is determined by the static strain to which they are constantly subjected.

EPIPHYSEAL-METAPHYSEAL FRACTURES.

Dr. Penn G. Skillern, Jr., called attention under the above heading to partial fracture of an epiphysis or of the adjacent portion of the shaft, latterly designated the metaphysis. This injury is not to be confused with the well-known epiphyseal injuries that

have been classified by Ollier as paraepiphyseal strains, paraepiphyseal sprains, and disjunction of epiphyses.

Illustrative of partial epiphyseal fracture is the following case:

M. E., male, aged four and a half years, while riding a bicycle was run into the curb by a coal wagon and fell off, injuring the right knee. Skiagram (Fig. 1) shows the separation of a small unciform fragment from the tibial side of the lower epiphysis of the femur. Gypsum case was applied. This fragment shows equally well in lateral view (Fig. 2). It will be noted that it was caused by *direct* violence, and therefore is not a true tear-fracture.

Illustrative of partial metaphyseal fracture is this case:

W. G., male, aged five, fell off the porch, injuring the right elbow. Examination 4 days later revealed swelling, tenderness and lemon-yellow ecchymosis about the external condyle. Skiagram (Fig. 3) showed partial fracture of the external corner of the lower metaphysis of the humerus, with but trifling displacement. The arm was dressed on an internal right-angle splint. This injury was also produced by direct violence.

In addition to these epiphyseal and metaphyseal fractures by direct violence, it is conceivable that tear-fractures of the metaphysis might arise from overstretching of a part of the articular capsule, or of one of its specially thickened bands, or ligaments. Tear-fractures of certain epiphyses, to which ligaments are attached, could also occur, in which event the epiphyseal bond of union is stronger than the ligamentous.

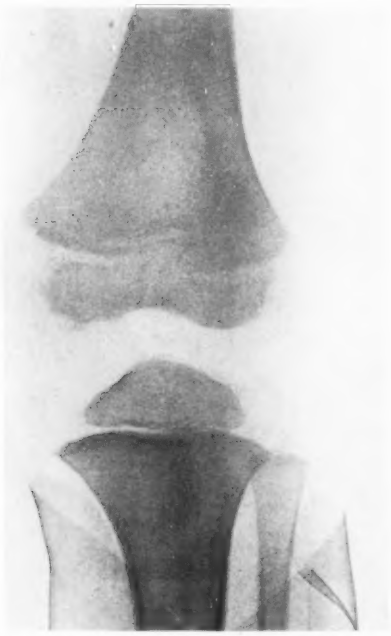
EXTENSIVE COMMINUTED FRACTURE OF THE LOWER THIRD OF A HUMERUS STUMP.

DR. PENN G. SKILLERN, JR., presented the following case more as a surgical curiosity than for any other reason.

C. W., male, aged thirty-three, clerk, fell backward, landing on the lower end of the stump of the left humerus. Clinical examination revealed swelling, preternatural mobility, crepitus and tenderness in the lower third of the humerus. Skiagram (Fig. 4) revealed comminution of the shaft of the left humerus, just above the lower end, into a dozen small fragments, with vertical splitting of the shaft. This was dressed upon an anterior and a posterior splint.

Sixteen years previously disarticulation at the left elbow-joint was performed for a gunshot injury to the forearm. Two years ago he fell, and had a clean transverse fracture of the same stump.

FIG. 1.

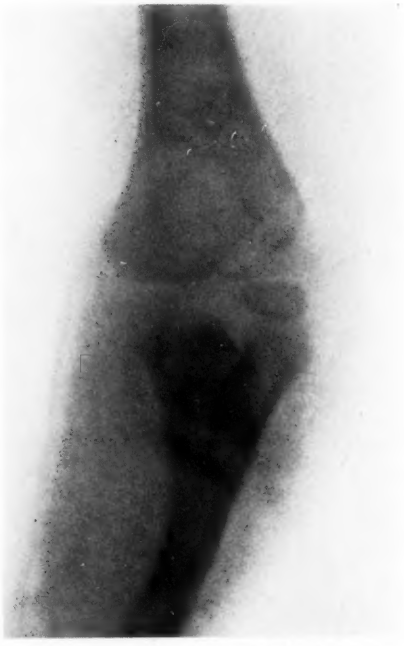


Partial fracture of lower epiphysis of femur. Anteroposterior view.

FIG. 2.

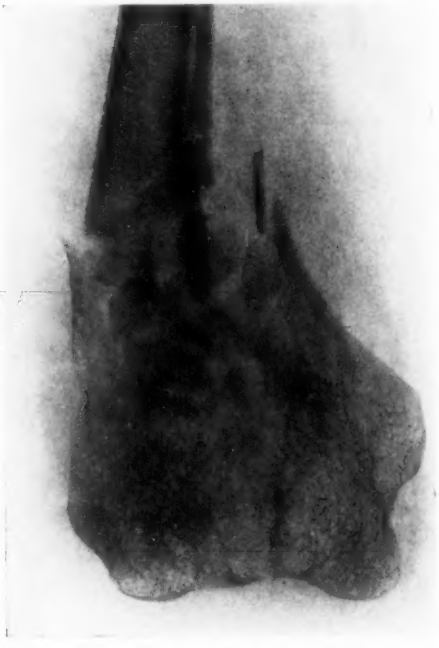
Partial fracture of lower epiphysis of femur. Lateral view.

FIG. 3.



Partial fracture of lower metaphysis of humerus.

FIG. 4.



Extensive comminuted fracture of lower third of humerus stump.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated meeting, held at the New York Academy of Medicine, November 26, 1913.

DR. CHARLES H. PECK, President *pro tem*, in the Chair.

VENTRAL HERNIA.

DR. ARTHUR S. VOSBURGH presented a woman, forty-four years old, who was admitted to Bellevue Hospital on September 17, 1913, suffering from a recurrent ventral hernia. Four years ago she had been operated at the Harlem Hospital for an umbilical hernia, and during her stay in that hospital a second operation was performed and an "eight-pound tumor" removed. Since then she had not menstruated.

Examination showed a large ventral hernia situated in the scar of the former operations. The mass, which was irregular and only partly reducible, presented several openings in the fascia. On September 19, 1913, under ether, the old scar was circumscribed and the peritoneum opened at a favorable point. The dissection of the intestines from their attachment to the old cicatrix was long and difficult. The intestines were held in a mass by broad adhesions. These were not disturbed, but all narrow bands were divided. The irregular openings in the fascia, one at the former location of the navel, the others nearer the pubis, made it impossible to do a Mayo overlapping operation, and the repair was accordingly made by coaptation obtained from side to side. Folded rubber tissue drains were inserted, a small dressing was applied along the line of suture, with broad bands of adhesive plaster incircling three-quarters of the trunk, covered by heavier dressing and an abdominal binder. The patient's

recovery was normal, excepting for a discharge of liquid fat for a week or ten days and a slight attack of pleurisy during the second week of her convalescence.

Dr. Vosburgh presented a second case of ventral hernia in the person of a woman, thirty-four years old, who was admitted to Bellevue Hospital on October 18, 1913. She was the mother of twelve children, and about six years ago, after the birth of a child, she noticed that there was a protrusion in the median line which increased in size with each subsequent pregnancy. On admission, the patient, a large, fat woman, presented an abdominal tumor of huge dimensions. In the recumbent position this was easily reducible, and disclosed a separation of the recti from a point four inches above the navel to within an inch or two of the pubes. The gap between the muscles was large enough to insert two fists side by side.

The operation in this case proved comparatively easy, occupying less than an hour. A large, elliptical section of integument and fat, together with a corresponding section of the fascia, much thinned, was removed. No adhesions were found, but the recti could not be made to meet by several inches and their sheaths were not opened. The repair was made by the Blake overlapping method, in the same manner as in the first case. The fat having been carefully removed from the left flap, it was drawn underneath the right flap by mattress sutures. In order to preserve the blood supply of the superficial flap, its fat was not removed, while the peritoneum and the pro-peritoneal tissues were depended upon to take care of the nutrition of the deeper flap. The wound was dressed in a manner similar to that in the first case; it healed by primary union and the patient was discharged on November 12, 1913.

Blake's method of treating this form of hernia, Dr. Vosburgh said, was described in *The Medical Record*, May 25, 1901. In his second case reported in that paper he did not dissect free the peritoneum, but included it in his flap. The Mayos' paper on umbilical hernia, published in the *Jour. of the Amer. Medical Association*, July 25, 1903, emphasized the importance of the dissection of the peritoneum and its independent suture, the deeper fascial flap being received in a pocket, as it were, of the superficial flap and its peritoneum.

MULTIPLE OSTEOMYELITIS OF FIFTEEN YEARS' DURATION, CURED BY AUTOGENOUS VACCINES.

Dr. A. V. Moschcowitz presented a man, thirty-two years old, who, seventeen years ago, suffered from an acute febrile disease, which, after three weeks' treatment at home, was diagnosticated as osteomyelitis of the right femur. He was then admitted to the Mt. Sinai Hospital, and after repeated and very extensive local operations, an exarticulation at the right hip-joint finally became imperative. During the following fourteen years, the disease successively involved the left lower jaw, the left malar bone, the right humerus, the left tibia, the left elbow-joint, the left ankle-joint and the lower part of the left femur, and in addition to these bone infections, there occurred also several subcutaneous, intermuscular and intramuscular abscesses. In every instance the infective agent was the staphylococcus aureus, which was also recovered from the blood. The patient was unable to state precisely the number of operations he underwent, but there were at least forty.

Finally, he was readmitted to Mt. Sinai Hospital on March 28, 1911, with an extensive osteomyelitis of the upper two-thirds of the left femur. This was operated on, and from the pus the staphylococcus was again cultivated. From this, an autogenous vaccine was prepared, and during his stay in the hospital he received several billions of cocci subcutaneously. Two years and nine months had elapsed since that time, and in view of the fact that the longest period during which he had hitherto remained free from an acute exacerbation was only eight months, the speaker thought he might now be confidently presented as a cured case.

ADAMANTINOMA OF THE JAW.

Dr. Alfred S. Taylor presented a man, thirty-seven years old, whom he had already shown at a meeting of the Society in 1909, after the second operation for an adamantinoma of the jaw, the first having been done in 1905.

In October, 1913, when the patient returned with a recurrence of the growth, about the size of an English walnut, it was evident that the lower jaw was so much eroded that further palliative procedures were out of the question and that a resec-

tion was imperative. The question naturally arose whether to do a primary bone transplant or a secondary one. The objection to the former was that there would be an open communication between the transplant and the wound in the mouth, but inasmuch as the only risk involved would be the loss of a few inches of one of the ribs, this method of procedure was decided upon, and on October 16, 1913, the involved section of the lower jaw was removed, extending from the second bicuspid back to the angle of the jaw, and including all the diseased bone, together with the soft tissues beyond the limits of the tumor. Silk sutures were inserted in the mucous membrane, three layers of catgut sutures beneath, and every precaution was taken to protect the wound from the mouth secretions. The tenth right rib was then exposed, and a section, together with its outer periosteum, was removed, and after trimming it to the proper size, it was inserted to fill the gap in the lower maxilla. A hole was bored in the jaw anteriorly with a Hudson drill and the anterior end of the rib pushed into it like a dowel. The posterior end of the rib was split vertically and made to fork over the lower end of the ramus of the jaw. This arrangement made a mechanically firm new jaw.

On the ninth day after the operation the wound showed some evidences of infection, due to communication with the mouth. But in spite of this the transplant remained firm. Six weeks had elapsed since the operation, and while there was still a small amount of discharge, the bone transplant gave evidence of being permanent, with preservation of excellent function of the jaw. Pathologically, the tumor was an adamantinoma. X-ray pictures, taken after six weeks, showed the piece of rib still in perfect condition, and in the position originally placed.

PITUITARY TUMOR: FRAZIER OPERATION.

Dr. John F. Erdmann presented a girl of fourteen who was admitted to the hospital on June 10, 1913, complaining chiefly of a loss of vision, which was practically complete, the patient being scarcely able to discern between daylight and darkness. Her family history was unimportant. In childhood, the girl had whooping-cough, measles, scarlatina and pleurisy, and she had suffered from occasional attacks of tonsillitis. Her present trouble began in February, 1913, when she first noticed that she could not read properly, often missing or repeating words and

lines, and when reading she noticed that the left side of the book would become blurred. For three months previous to that time she had noticed that she could not see the blackboard from her seat in the rear of the school-room, and she was finally compelled to move to the front row of seats in order to see what the teacher was writing. The eyesight gradually grew worse, and in February she was compelled to leave school. Two months later she awoke one morning practically blind, and since then she has had continuous visions of different objects before her eyes. In April she began to complain of severe headaches, especially on the left side. These were only temporary. Her appetite was fairly good and she slept well. She suffered from constipation; also occasional vomiting, accompanied by nausea and vertigo. An examination of the eyes made by Dr. John E. Virden showed complete double optic atrophy.

Five weeks ago, Dr. Erdmann said, he operated on this patient by the Frazier method. Upon exposing the frontal lobe, he found a large collection of fluid between the dura and the arachnoid, which was removed by puncturing the dura. Upon exposing the sella turcica it was apparently slightly enlarged, and in the region of the floor of the sella a dark, grayish object protruded, resembling portions of a cyst wall. This was extirpated as completely as possible, and the wound closed.

For four or five days following the operation, the patient was very irritable, with a temperature ranging between 103° and 106°. This gradually subsided, and she left the hospital two weeks later. At the present time the optic atrophy was still apparently complete, although the patient insisted that she could at times distinguish certain objects.

Pathologically, the specimen showed disintegration of the structure of the pituitary body, with fairly well marked chronic inflammatory changes and localized areas of hemorrhage. There was a considerable development of hyaline connective tissue, which formed the wall of the "cyst," and passed through both the anterior or prehypophysis and the intermediate portions of the gland. The lymphoid cells and some polynuclears also suggested the presence of inflammation. The normal histology of the gland was greatly distorted, and the epithelial cells of the anterior lobe were compressed. In some sections there were areas

of fibrinous-like material and œdema. There was no histological evidence of tumor formation, the changes being of a degenerative and inflammatory character.

TUMOR OF THE HYPOPHYSIS.

DR. CHARLES A. ELSBERG presented a man, thirty-seven years old, who came under his observation in January, 1913, being referred by Dr. Emil Gruening. For two years the patient had complained of increasing deterioration of vision, without other symptoms. Dr. Gruening's examination showed that there was a temporal hemianopsia and a much contracted visual field on the left side, and that only slight light perception remained in the right eye. X-ray showed marked enlargement of the sella turcica.

The patient was operated upon by Dr. Elsberg at the Neurological Institute in February. The hypophysis was exposed by the transfrontal route of Frazier, and a tumor of the hypophysis—part of which surrounded the optic chiasm—was found. A large piece of the tumor was removed and proved to be an adenoma. Convalescence from the operation was uncomplicated and eyesight began to improve within 48 hours of the operation. The left field of vision steadily improved and most of the temporal defect has disappeared, while the sight of the right eye has not returned. The patient has been able to return to his work as a tailor, and is again able to sew and to read the newspaper. The scar from the operative incision is only slightly noticeable.

Dr. Elsberg presented a second case, in the person of a boy upon whom operation was done six months ago.

The patient had, for one year, increasing loss of sight in both eyes with frequent attacks of headache; he was referred to the speaker by Dr. Jelliffe. Examination showed that the left eye was blind, and that there was a temporal hemianopsia with markedly contracted field of vision of the right eye. X-ray examination showed a decided enlargement of the sella turcica, the posterior clinoid processes having entirely been destroyed.

Dr. Elsberg operated upon the patient, who was a very frail child, at the Neurological Institute, and exposed the sella turcica by the transfrontal route as modified by himself.

There was a marked collection of the fluid on the under surface of the left frontal lobe, and after this had been evacuated, further manipulations were deferred to a second stage. The bone

flap was returned into place and the wound closed. The improvement in eyesight was very marked and the temporal defect in the right eye has been steadily growing smaller, so that further operative interference has been put off indefinitely. The improvement is undoubtedly due to the decompressive effect of the operation. If necessary, a second operation will be done.

Dr. Elsberg also showed a patient from whom he had removed a mucous cyst from the frontal bone, with very satisfactory result, the deformity due to dislocation of the eyeball having entirely disappeared, and the scar being barely visible.

In connection with the first two patients presented by Dr. Elsberg, he made some remarks upon operations for exposure of the hypophysis, and stated that he believed that the transfrontal route suggested by Dr. Frazier, of Philadelphia, was an excellent method for exposing the contents of the sella turcica. The operation is not at all difficult, and the surgeon obtains an excellent view of the hypophysis—as good a view as one ordinarily obtains of the Gasserian ganglion in operations for removal of the ganglion or division of its sensory root.

The speaker described the modifications of Frazier's operation that he has adopted. These consist of removing part of the supra-orbital margin together with the bone flap and of making the base of the osteoplastic flap in or near the median line and thus avoiding an incision on the forehead. It is not necessary to remove part of the supra-orbital margin separately, but it can easily be included in the bone flap. The advantage of this is that there is no danger of necrosis of the supra-orbital margin when it is later replaced.

The speaker declared it as his belief that in properly selected cases the transfrontal operation was superior to any of the intranasal methods of approach, because the latter were, in the majority of instances, only decompressive operations.

FRACTURE OF THE ACROMION PROCESS OF THE SCAPULA.

Dr. William Darrach presented a man, fifty years old, who on May 12, 1913, was struck by a railroad train, receiving a fracture of the skull, of the lower extremity of the humerus and of the scapula. After three months' treatment in various hospitals he came to Roosevelt Hospital, August 20, 1913, complaining of limitation of movement at the shoulder and elbow. The humerus

showed a T-shaped fracture with tremendous callus formation. By removing a portion of the latter from the region of the capitellum his flexion was increased 15°. There was but 30° of abduction at the shoulder with marked loss of power. Examination showed a fracture of the acromion process at its junction with the spine with very free motion between the fragments, the outer one having an excursion of one inch. On cutting down on the site of fracture, the fragments were found widely separated and joined by a band of firm connective tissue. The latter was cut away and the bone edges freshened. Holes were bored and two heavy twisted silk sutures passed, holding the fragments in good apposition. The shoulder was immobilized for four weeks. At the end of that time union seemed solid. Two months later there was no motion between the fragments and the motion at the shoulder had markedly increased. X-ray showed the fragments to be in close apposition.

Dr. Burton J. Lee said that about a month ago he saw a similar case where the accident had occurred as the result of a football injury, with about as much displacement as in the case shown by Dr. Darrach. He made a vertical incision from the acromion to the tip of the coracoid process, and finding that the clavicle could not be replaced without removing the interarticular fibrocartilage, removed the latter structure. He then roughened the articular surfaces to secure at least fibrous union and passed two kangaroo ligatures through the coraco-acromion ligament and the clavicle and a third about the clavicle and through the coracoid process. The division of a few fibres of the trapezius at the outer part of the posterior margin of the clavicle seemed to be an essential feature of the operation. About four weeks had elapsed since the operation, and while the deformity was absolutely done away with, it was still too early to speak of the ultimate outcome as regarded function.

Dr. Charles H. Peck said that several years ago he had a case where he inserted a Lane plate between the outer end of the clavicle and the acromion process, with the idea in mind of removing the plate later, if necessary. It held the parts in absolute apposition, and when it was removed, about two months later, restoration of function was very perfect, and there was no tendency toward a return of the deformity.

SUBHEPATIC ABSCESS FOLLOWING OPERATION FOR ACUTE APPENDICITIS.

DR. BURTON J. LEE presented a boy, seventeen years old, who was admitted to Dr. Roger's service in Bellevue Hospital on August 3, 1913, about 9 P.M., and operated upon the following day by Dr. Rogers. Upon opening the abdomen a markedly gangrenous appendix was encountered lying in an abscess cavity which contained about two ounces of pus.

Following the operation, the patient's temperature ranged between 99° and 103°; his pulse between 96 and 100. He complained of pain in the region of the wound and looked sick and miserable. His tongue remained heavily coated and his appetite was poor. His bowels responded satisfactorily to catharsis. On palpation, the abdomen was soft, without distention or tenderness, and examination of the wound itself on several occasions failed to reveal any definite pocketing of pus. His blood count, made two and a half weeks after the operation, showed a leucocytosis of 32,000, with 92 per cent. of polynuclears, and this blood picture remained quite constant for a month after the operation. During this entire period the boy was steadily going down hill, with gradual loss of flesh, a weak, soft pulse, usually over 100, and an appearance indicating more and more sepsis.

A radiographic examination, made by Dr. I. S. Hirsch three weeks after the operation, gave the following results: The chest showed the diaphragmatic shadow on the right to be considerably elevated, indicating a possible subphrenic condition. Physical examination of the chest was negative. A month after the original operation an area of definite tenderness was first made out just above the wound, directly below the right costal margin, at about the level of the ninth costal cartilage. No tenderness could be elicited by deep pressure in the right flank.

As the patient's condition was steadily growing worse, an exploratory operation was decided on, and this was done by Dr. Lee on September 3, 1913. An incision was made roughly parallel to the costal margin on the right side, over the tender area, the rectus muscle being cut across and the peritoneum opened. The liver edge was recognized, and an exploring finger passed just beneath the liver, and above the hepatic flexure encountered adhesions. Upon breaking through these adhesions, an abscess

cavity was opened containing a few ounces of thick, yellowish pus, with foul odor. This cavity did not, apparently, connect directly with the original abscess cavity in the appendicular region. Drainage was secured with a cigarette drain and rubber tube. The boy's recovery was without further incident, and he was discharged from the hospital on October 20, 1913, with both sinuses healed and in good physical condition. At the present time his health was excellent and the wounds seemed firm.

INTESTINAL ADHESIONS FOLLOWING APPENDICITIS.

DR. HENRY H. M. LYLE presented a girl who was originally operated upon at St. Luke's Hospital on September 26, 1911, when a chronically inflamed appendix was removed. She made an uneventful recovery and returned home. Subsequently, symptoms of partial intestinal obstruction developed; these gradually became more pronounced and she returned to the hospital eight months later, suffering from what was supposed to be post-operative adhesions, which were attributed to the use of iodine on the skin at the time of the operation, for at that time no precautions were taken to protect the iodized skin. In the second operation no iodine was used. There were no adhesions to the abdominal wall, but the omentum had bound the ascending colon and cæcum to the transverse colon. This was freed, the raw surfaces were covered and the area touched with albolene. No abdominal pads were used.

Within a month a similar train of symptoms developed and the patient returned for a third operation. This time they were certain that the iodine was not to blame, and from the nature of the symptoms they concluded that they had to deal with the same condition. The third operation was performed in September, 1912. Precisely similar conditions were encountered and they were treated in the same way, excepting that the patient was placed on her left side, with her right side up, and was kept in that position. This time she made a perfect recovery and had since remained well.

Dr. Lyle said he had had occasion to reopen some of his own abdominal cases, as well as those of other surgeons, and in studying them he had been struck by the frequency with which the above conditions were found, and this had led him to place all clean cases on the left side, with the right side up, and keep them

in that position for five or six days. At the present time they were carrying on some work in the X-ray laboratory with the object of demonstrating the value of that position after certain abdominal operations.

DR. PECK said he was quite firmly convinced that iodine peritonitis did occur from time to time, and he recalled two instances where he thought that absolute proof of that fact had been found. In one of those cases there was an immense mass of adhesions which he attributed to contamination with iodine. About the same time he operated on another case, an inoperable carcinoma of the rectum, where death occurred within two weeks and where the autopsy showed plastic adhesions in all parts of the peritoneal cavity, which had been contaminated with iodine at the time of the operation by exploration with the gloved hand, while regions not so invaded were entirely free from adhesions.

Dr. Peck said that since that time he had seen several cases with extensive intra-abdominal adhesions which he thought could be ascribed to the use of iodine.

DR. PARKER SYMS thought the suggestion made by Dr. Lyle was a very valuable one, but as to the cause of post-operative adhesions, he was inclined to attribute them to peritonitis, most probably due to a more or less mild type of infection. Of course peritonitis may be due to a chemical irritant.

The only case of this kind that has come under his observation in the last few years happened to be one of the few cases in which he has not used iodine in the preparation of the skin.

DR. LYLE, in reply to a question, said that while he had abandoned the use of iodine in these cases, the post-operative adhesions in the case he had presented were apparently not the result of the iodine, as had been demonstrated by keeping this patient in the left lateral position after the third operation. In using iodine, if the bowel came in contact with the skin, it had been shown that the former gave the iodine reaction.

DR. MOSCHCOWITZ said that at the Mt. Sinai Hospital he used iodine only in those cases where there were special indications for it, such as a sinus infection. In other cases they depended on soap, ether and bichloride. Personally, he had seen iodine produce an annoying dermatitis, particularly where it came in contact with the adhesive plaster.

DR. ERDMANN said that after a very extensive use of iodine preliminary to abdominal operations during the past three years, numbering at least 300 patients, he had only seen a dermatitis produced in two, and in those cases where it was used in connection with adhesive plaster, there was less irritation underneath the plaster than outside of it. He could not recall a single instance where post-operative intestinal adhesions could be attributed to the use of the iodine. In the application of the iodine, the speaker said, they had dispensed with the preliminary swabbing with benzine.

DR. WILLIAM A. DOWNES said he had used the iodine for the past three years, since Dr. Gibson read his paper on the subject before the Surgical Society, and his results had been practically in accord with those of Dr. Erdmann. In the use of the iodine, no friction should be employed, either at the time of its application, or when the operation is completed, such as is produced by the use of alcohol on gauze in the effort to remove the excess of iodine remaining on the skin. The skin surface should be dried gently before dressings or adhesive plaster are applied and blistering will practically never occur.

DR. ELSBERG said he had used iodine for a number of years in practically all kinds of operations, and his results had been very satisfactory. In the beginning, he had been conservative in using the method, but with increasing experience, he had come to the conclusion that iodine sterilization was both safe and efficient. In abdominal operations, however, procedures should be adopted which would prevent the iodine being carried to the peritoneal coverings of the abdominal viscera which would result in the formation of adhesions. This can be satisfactorily accomplished by fixing towels to the edges of the peritoneal surfaces by means of small clamps.

DR. PECK said that if the skin was properly protected and the peritoneum was guarded against contamination, there was comparatively little danger of resulting post-operative adhesions. On the other hand, such adhesions might result from the use of the iodine without the knowledge of the surgeon unless they were subsequently brought to his attention accidentally, as they undoubtedly are absorbed within a few weeks, and generally produce no symptoms.

THORACIC ANEURISM TREATED WITH MERCURY AND SALVARSAN.

Dr. William C. Lusk showed five cases of thoracic aneurism which had been treated with mercury and salvarsan, the details of which are reported in his paper read at this meeting. Cases I, II and III, early in their treatment, had been given a significant amount of potassium iodide besides, which was stopped, however, when the existence of an incompatibility between it and salvarsan was believed to have been observed. The first four of these cases were the same ones that he had shown before this Society just one year ago, as results of the operation of wiring with electrolysis. These four cases were all of them to-day much stronger and healthier, capable of much greater activity, and freer from the sense of impending return of symptoms, than they were a year ago, and were now possessed with a sense of well being not then entertained.

Case I had in the year's interval nearly strangled a number of times, and now he was able to walk easily a mile and a half a day. Cough and expectoration were very little and he slept all night. He had not been able to work.

Case II a year ago, taking mixed treatment, was working as bar-tender in comfort as long as he was taking his mixed treatment, but whenever he stopped his medication pain would recur, usually following exertion. To-day he has much greater physical endurance, being in excellent health, standing all day in the bar, walking about two miles a day, and the only thing that has recently excited a little pain has been when he has walked a little fast as far as seven or eight blocks, the pain subsiding as soon as he rests.

Case III, who has always been capable of greater physical exertion than any of the others, after having had mixed treatment followed by neosalvarsan, during last spring and summer undertook considerable labor of quite a heavy nature. His excessive exertions would always end sooner or later in producing temporary pain. In June he spat up blood in mouthfuls. In October and early November, during which time he was not strenuously employed, he had a little pain for an hour or two a day, probably the result of his physical excesses during the summer. On November 15 he walked ten miles without any pain resulting. His

Wassermann, which last February had become negative, has recently become mildly positive again.

Case IV was one who after his wiring (October 1, 1912) neglected to take mixed treatment and pain began to recur in about ten weeks. The few doses of mixed treatment which he was induced to take helped his symptoms, but he got worse until neosalvarsan was administered (April and June, 1913), after which his symptoms were relieved and his power of endurance greatly increased. He had no trouble all summer, doing light work in a club, and walking three or four miles a day. Early in September he began to have occasional pains, which with injections of mercury salycilate and two small doses of salvarsan, have now practically disappeared again.

Case V came under observation the end of August with a huge aneurism 6½ inches broad and 4 inches high, projecting from the upper part of the thorax and base of the neck, which had first put in its appearance five months before. With intramuscular injections of mercury salycilate and small doses of salvarsan, the tumor had increased in size only one-quarter inch in its vertical diameter, the tension and expansibility were both much diminished, and the pain, which before was continuous, was now very slight and dependent upon posture.

THE ANTISPECIFIC REMEDIES IN THE TREATMENT OF THORACIC ANEURISM.

Dr. William C. Lusk read a paper with the above title.

BOOK REVIEW

A Manual of Surgical Treatment. By Sir W. Watson Cheyne, Bart., C.B., D.Sc., LL.D., F.R.C.S., F.R.S., Hon. Surgeon in Ordinary to H. M. the King; Senior Surgeon to King's College Hospital, and F. F. Burghard, M.S. (Lond.), F.R.C.S., Surgeon to King's College Hospital, and Senior Surgeon to The Children's Hospital, Paddington Green, London. New (2d) edition. Thoroughly revised and largely rewritten. In five octavo volumes. Lea & Febiger, Publishers, Philadelphia and New York, 1913.

Volumes I to IV have already been reviewed in the Annals of Surgery; Volume V is now before us. It treats of (1) surgical affections of the pancreas, liver, and spleen (6 chapters); (2) surgical affections of the neck (7 chapters); (3) surgical affections of the breast and thorax (10 chapters). The rest of the book, nearly 400 pages, is devoted to affections of the genito-urinary organs.

The high standard attained in the previous volumes is fully maintained in this valuable and interesting work. Too much praise cannot be expressed for the thoroughness and soundness of the work and the clearness with which the practical side is emphasized. The work is unique in its scope and can be consulted to advantage by even the most experienced, and the beginner will find it a regular treasure-house of useful information.

The only section that does not compare quite favorably to the rest of the book is that devoted to affections of the genito-urinary organs. Here, the procedures and armamentarium recommended are in many cases much behind the time. We note with some regret that, like many other distinguished operators, the senior

author has yielded to the temptation of describing a new method of performing nephropexy.

The thorough revision of the first edition of the book with admirable condensation and the great pains taken to bring it up to date, whilst avoiding the pitfalls of new and untried measures, gives this splendid work a place in our surgical literature which will last for a long time.

CHARLES L. GIBSON.

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